Carlsbad Watershed Management Area Water Quality Improvement Plan Fiscal Year 2022-2023 Annual Report

January 31, 2024

Submitted by the
Carlsbad Watershed Management Area Responsible Agencies

City of Carlsbad
City of Encinitas
City of Escondido
City of Oceanside
City of San Marcos
City of Solana Beach
City of Vista
County of San Diego

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Acronyms and Abbreviations

303(d) list	California's Clean Water Act listing of impaired waterbodies
AB411	Assembly Bill 411 (requires beach water quality FIB monitoring)
AWM	County of San Diego Department of Agriculture, Weights, and Measures
AWQ	Agricultural Water Quality
Basin Plan	Water Quality Control Plan for the San Diego Region
Bight	Southern California Bight Regional Monitoring Program
BMI	Benthic Macroinvertebrate
BMP	Best Management Practice
Caltrans	California Department of Transportation
CCTV	Closed Circuit Television
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFU/100 mL	Colony Forming Units per 100 milliliters
CRAM	California Rapid Assessment Method
CSCI	California Stream Condition Index
CSP	County of San Diego Cleanup and Sanitation Program
DPW	Department of Public Works
FIB	Fecal Indicator Bacteria
FY	Fiscal Year
HA	Hydrologic Area
HPWQC	Highest Priority Water Quality Condition
IBI	Index of Biotic Integrity
IC/ID	Illegal Connection and Illicit Discharge
IDDE	Illicit Discharge Detection and Elimination
ILACSD	I Love A Clean San Diego
IRWM	San Diego Region Integrated Regional Water Management
JRMP	Jurisdictional Runoff Management Program
mg/L	milligram per Liter
mL	milliliter
MS4	Municipal Separate Storm Sewer System (storm drain system)
MS4 Permit	San Diego Region National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region
N/A	Not Applicable
NAL	Non-Storm Water Action Level
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
PWQC	Priority Water Quality Condition
RA	Responsible Agency
REC-1	Water Contact Recreational Beneficial Use
RI/FS	Remedial Investigation/Feasibility Study
RMAR	Regional Monitoring and Assessment Report
ROWD	Report of Waste Discharge
RWQCB	San Diego Regional Water Quality Control Board

SAA	Streambed Alteration Agreement
SAL	Storm Water Action Level
SCCWRP	Southern California Coastal Water Research Project
SEJPA	San Elijo Joint Power Authority
SELER	San Elijo Lagoon Ecological Reserve
SEP	Supplemental Environmental Project
SHELL	Shellfish Harvesting Beneficial Use
SMC	Storm Water Monitoring Coalition
Sq. mi.	Square mile(s)
SQO	Sediment Quality Objective
SSO	Sanitary Sewer Overflow
STV	Statistical Threshold Value
SWAMP	Surface Water Ambient Monitoring Program
TMDL	Total Maximum Daily Load
TWAS	Temporary Watershed Assessment Station
UV	Ultraviolet
WDR	Waste Discharge Requirements
WMA	Watershed Management Area
WPO	Watershed Protection Ordinance
WQIP	Water Quality Improvement Plan
WQO	Water Quality Objective

1 Introduction

The Carlsbad Watershed Management Area (WMA) Water Quality Improvement Plan (WQIP) was prepared by the cities of Carlsbad, Encinitas, Escondido, Oceanside, San Marcos, Solana Beach, Vista, and the County of San Diego [herein referred to as Responsible Agencies (RAs)] in accordance with the San Diego Region *National Pollutant Discharge Elimination System (NPDES) Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer System (MS4) Draining the Watersheds Within the San Diego Region* (MS4 Permit) under Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100. The Carlsbad WMA WQIP (WQIP) was accepted by the San Diego Regional Water Quality Control Board (RWQCB) in November 2016. The WQIP was updated in May 2018 and September 2021 (Carlsbad WMA Responsible Agencies, 2021).

The purpose of the WQIP is to guide the Responsible Agencies' jurisdictional and watershed efforts, including Jurisdictional Runoff Management Programs (JRMPs), toward achieving improved water quality in storm water discharges and receiving water bodies. The WQIP describes the processes established and the data and information evaluated to prioritize water quality conditions and implementation efforts in the watershed. The current accepted WQIP can be found on the Project Clean Water website (www.projectcleanwater.org).

This WQIP Annual Report summarizes WQIP implementation during the applicable reporting periods:

- JRMP and WQIP implementation period, July 1, 2022, through June 30, 2023 [Fiscal Year (FY) 23]; and
- monitoring and assessment program period, October 1, 2022, through September 30, 2023.

The objective of the Annual Report is to present the implementation outcomes of the WQIP and corresponding JRMPs, progress toward WQIP numeric goals, and monitoring and assessment program findings (Figure 1). While the MS4 Permit dictates compliance requirements for plan development, implementation, and reporting, the implementation information in this annual report is presented without specific MS4 Permit references for easier readability. Appendix A provides details regarding specific MS4 Permit requirements and their location within the Annual Report for compliance clarity.

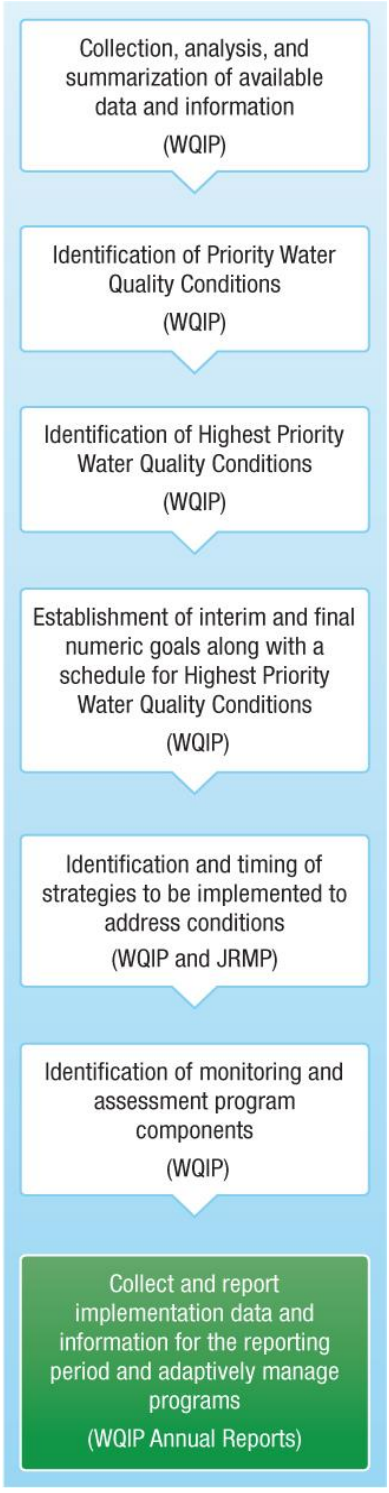

Figure 1: WQIP and WQIP Annual Report Items

WQIP Update

The RAs submitted a revised WQIP in September 2021, and the RWQCB accepted the 2021 WQIP on December 13, 2021. The update focused on the Agua Hedionda HA, specifically to analyze bacteria data concerning the impacts of the beneficial uses (Shellfish Harvesting and Contact Recreation Use) in the Agua Hedionda Lagoon and tributaries (see Section 5.1.1 of this report for more details on the update). This Annual Report reflects implementation efforts of the September 2021 WQIP.

WQIP Annual Report Comment Letter

The RAs received a June 19, 2023 comment letter from the RWQCB, *2021-2022 Water Quality Improvement Plan (WQIP) Annual Report Review: Carlsbad Watershed Management Area (WMA).* Appendix B of this report provides the comment letter and RA's September 6, 2023 response letter.

The letter requests the following items to be included in the FY23 CWMA WQIP Annual Report:

- By January 31, 2024, the WQIP Copermittees must assess if the Bight '23 monitoring program also meets the monitoring requirements for the State Sediment Control Plan required under D.1.e(2) according to the San Diego Water Board's email sent to all Copermittees dated 1/27/23.

  The Carlsbad WMA Copermittees confirm that the Bight '23 monitoring program meets the monitoring requirements for the State Sediment Control Plan required under MS4 Permit Provision D.1.e(2).

- With the data collected to comply with Resolution R9-2014-0020, by the next WQIP Annual Report due January 31, 2024, the City of Oceanside shall:
  1. Tabulate all collected monitoring data (2016- 2022) into a single Excel spreadsheet format,
  2. Submit supporting documentation that shows all data collected was uploaded into the California Environmental Data Exchange Network (CEDEN) website,
  3. Present data trends from 2016-2022 for nitrogen, phosphorus, dissolved oxygen, macro algae biomass and cover,
  4. Show nitrogen and phosphorus ratios for each month where data was collected between 2016-2022, and
  5. Analyze/discuss relationships with phosphorus and algae, and nitrogen and algae.

  The City of Oceanside responded to this request in the September 6th, 2023 letter, Appendix B, and provides requested data in Attachment 1 of this report.

- By the next WQIP Annual Report due January 31, 2024, the City of Oceanside shall identify what adaptive management strategies will be used to periodically check on conditions in Loma Alta Slough now that the monitoring required to comply with R9-2014-0020 has concluded. Since Loma Alta Slough continues to be 303(d) listed for Eutrophication, the City of Oceanside shall assess the effectiveness of actions to date and consider potential revisions to numeric goals, strategies, and schedules for the Loma Alta HA listed in the Carlsbad WQIP.

  The City of Oceanside responded to this request in the September 6th, 2023 letter, Appendix B. The city is continuing to implement all Oceanside strategies identified in the Carlsbad WMA WQIP.

1.1 Carlsbad Watershed Management Area

The Carlsbad WMA is approximately 211 square miles (sq. mi.) and includes six individual hydrologic areas (HAs) in northern San Diego County. The WMA contains the entire cities of Carlsbad, San Marcos, and Encinitas and portions of Oceanside, Vista, Escondido, Solana Beach, and San Diego County unincorporated areas. The WMA is bordered by the San Luis Rey River WMA to the north and the San Dieguito River WMA to the south, Figure 2. The Carlsbad WMA reaches inland nearly 24 miles to just northeast of Lake Wohlford. The maximum elevation of the WMA is approximately 2,400 feet, and it extends to sea level at the Pacific Ocean. Various land uses are present, including residential, commercial, industrial, freeways, agriculture, and vacant/undeveloped areas. About 75% of the land is privately owned. The Carlsbad WMA is the third most densely populated watershed in the San Diego Region.

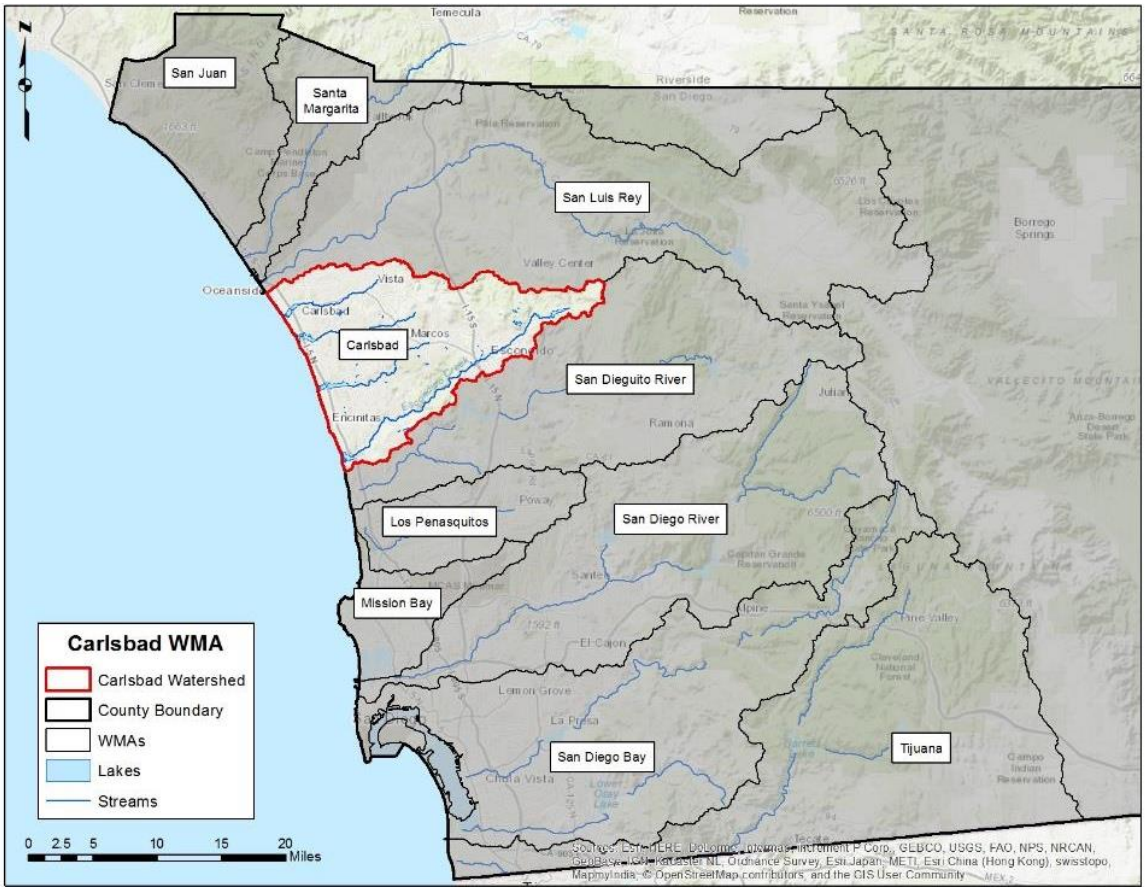

Figure 2: Carlsbad Watershed Management Area within the San Diego Region

Carlsbad WMA WQIP Goal
To protect, preserve, enhance and restore water quality and designated beneficial uses of waterways within the watershed.

Carlsbad WMA WQIP Desired Outcome
To improve water quality in MS4 discharges and receiving waters.

The Carlsbad WMA includes waterways and lagoons that serve as significant cultural, recreational, economic, and environmental resources that provide critical habitats for birds, fish, and plants. RAs establish and implement programs to protect, restore, and enhance WMA conditions while working together to have comprehensive WMA and HA planning efforts. The RAs' desired outcome for the Carlsbad WMA is to improve water quality conditions of wet weather MS4 discharges and receiving waters as well as eliminate non-storm water and illicit MS4 discharges through the implementation of storm water programs. These efforts are aligned with the overarching WQIP goal to protect, preserve, enhance, and restore water quality and designated beneficial uses of waterways.

The Carlsbad WMA HAs include Loma Alta, Buena Vista Creek, Agua Hedionda, Encinas, San Marcos, and Escondido Creek, all of which have different discharge points to lagoons or the Pacific Ocean (Figure 3). Due to the impoundment of waters at Lake San Marcos, the San Marcos HA is effectively split into two separate drainage areas: the drainage area above Lake San Marcos (also known as Upper San Marcos HA); and the drainage area below Lake San Marcos (also known as Lower San Marcos HA).

The RAs within the Carlsbad WMA include the following eight municipalities:

- City of Carlsbad
- City of Encinitas
- City of Escondido
- City of Oceanside
- City of San Marcos
- City of Solana Beach
- City of Vista
- County of San Diego

The WMA composition by jurisdictional land area for each of the six HAs is presented in Table 1 below.

Table 1: Jurisdictional Breakdown of Carlsbad WMA

Watershed (HA No.)	Ultimate Receiving Waterbody(ies)	Size (sq. mi.)	Percentage of WMA	Jurisdictional Percentage Breakdown							
				Carlsbad	Encinitas	Escondido	Oceanside	San Marcos	Solana Beach	Vista	County of San Diego
Carlsbad WMA (904)	Pacific Ocean	211.5	100%	18%	9%	13%	8%	11%	1%	8%	32%
Loma Alta (904.10)	Loma Alta Slough and Pacific Ocean	9.8	4.5%	-	-	-	97%	-	-	3%	-
Buena Vista Creek (904.20)	Buena Vista Lagoon and Pacific Ocean	22.6	11%	19%	-	-	25%	-	-	45%	11%
Aqua Hedionda (904.30)	Aqua Hedionda Lagoon and Pacific Ocean	29.4	14%	41%	-	-	6%	5%	-	24%	24%
Encinas (904.40)	Pacific Ocean	5.4	2.5%	100%	-	-	-	-	-	-	-
San Marcos (904.50)	Batiquitos Lagoon and Pacific Ocean	59.7	28%	29%	15%	5%	-	33%	-	-	18%
Escondido Creek (904.60)	San Elijo Lagoon and Pacific Ocean	84.6	40%	-	11%	29%	-	4%	1%	-	55%

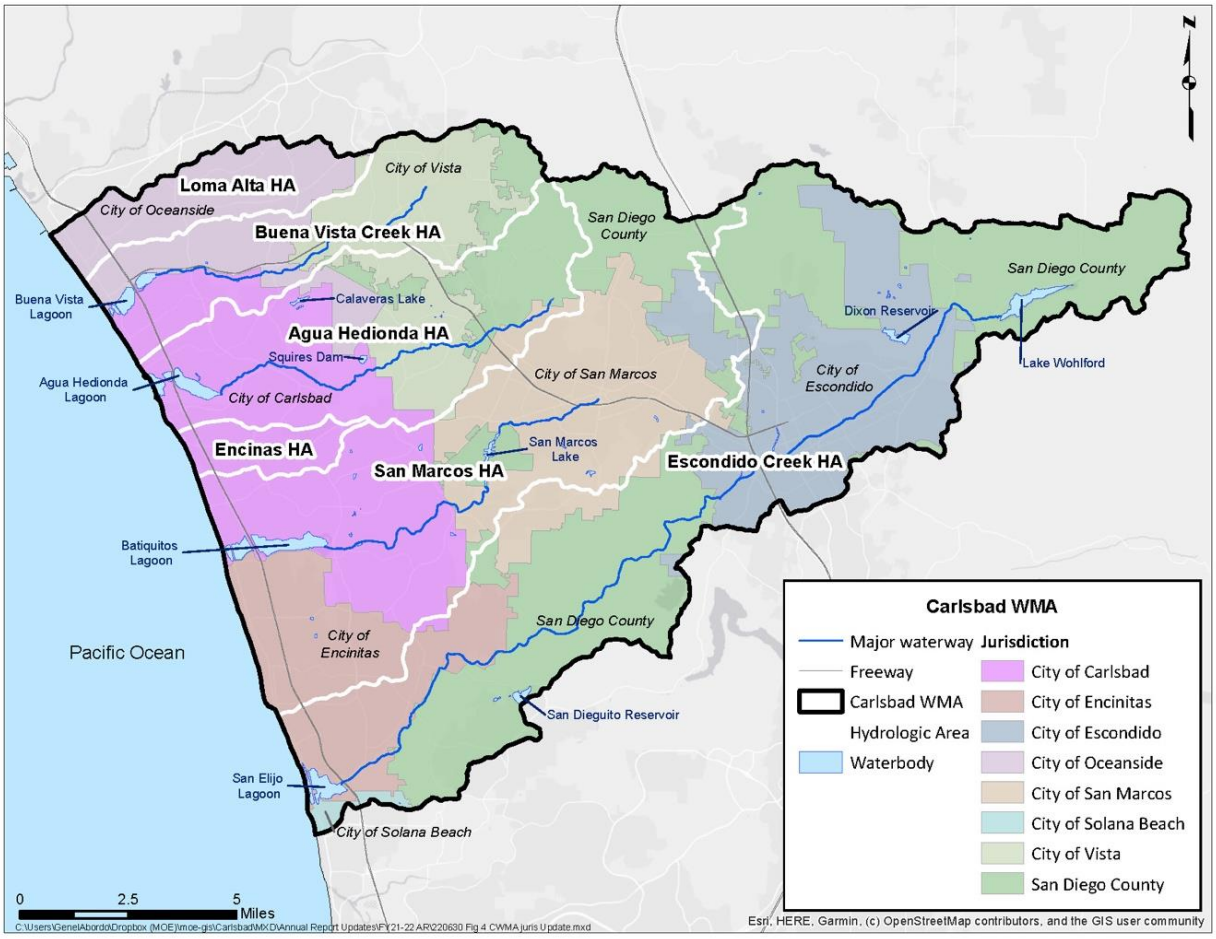

Figure 3: Carlsbad Watershed Management Area

1.2 Document Organization

The WQIP Annual Report for FY23 is organized as follows:

Section 1 Introduction. This section provides an overview of the background and purpose of the report and a description of the watershed.

Section 2 Water Quality Conditions. This section presents the priority and highest priority water quality conditions for the watershed by HA.

Section 3 Water Quality Improvement Goals, Schedules, and Strategies. This section presents progress toward numeric goals and schedules, goal-related monitoring where applicable, and highlights reporting period implementation efforts related to the highest priority water quality conditions and multi-benefit strategies.

Section 4 Water Quality Monitoring and Assessment Program. This section summarizes the monitoring performed during the reporting period, including receiving water monitoring, MS4 outfall monitoring, and special studies.

Section 5 Adaptive Management and Revisions. This section summarizes WQIP updates, adaptive management efforts, and minor modifications identified for the WQIP, JRMPs, and BMP Design Manuals.

Section 6 Conclusions. This section provides conclusions based on the data collected and assessments conducted during the implementation of the WQIP in FY23.

Section 7 References. This section lists the sources used to prepare this Annual Report.

2 Water Quality Conditions

In the WQIP, RAs identified Priority Water Quality Conditions (PWQCs) by evaluating receiving water conditions, MS4 discharges and their potential impacts, and potential sources of pollutants[1] in the WMA. The WQIP also details the process the RAs used to identify the Highest Priority Water Quality Conditions (HPWQCs). Table 2 and Table 3 list the HA-specific PWQCs and HPWQCs, respectively, per the 2021 WQIP.

Priority Water Quality Conditions are pollutants, stressors, and/or receiving waters conditions that have been identified through the Carlsbad WMA WQIP assessment process.

Table 2: Carlsbad WMA WQIP Priority Water Quality Conditions (from 2021 WQIP)

Hydrologic Area	Applicable Receiving Water	PWQC (pollutant or stressor)	Temporal Extent
All	All within WMA	Trash	Dry and Wet Weather
	All within WMA[1]	Riparian Habitat Degradation	Dry and Wet Weather
Loma Alta	Loma Alta Slough	Eutrophic conditions	Dry Weather (Between May and October)
	Loma Alta Slough	Indicator Bacteria	Dry and Wet Weather
	Loma Alta Creek	Toxicity	Dry Weather
	Pacific Ocean Shoreline at Loma Alta Creek Mouth	Indicator Bacteria	Dry and Wet Weather
Buena Vista Creek	Buena Vista Lagoon	Indicator Bacteria	Dry and Wet Weather
	Buena Vista Lagoon	Sediment/Siltation	Dry and Wet Weather
	Buena Vista Lagoon	Nutrients[2]	Dry Weather
Agua Hedionda	Agua Hedionda Creek	Indicator Bacteria	Dry and Wet Weather
	Agua Hedionda Creek	Toxicity	Dry and Wet Weather
	Agua Hedionda Creek	Nutrients[2]	Dry and Wet Weather
	Agua Hedionda Creek	Sediment – Erosion - Hydromodification	Wet Weather
	Agua Hedionda Lagoon (SHELL)[3]	Fecal Indicator Bacteria	Wet Weather
	Agua Hedionda Lagoon (REC-1)[4]	Enterococcus	Dry and Wet Weather
	Buena Creek	Nitrate and Nitrite	Dry Weather
San Marcos	Lower – Pacific Ocean Shoreline at Moonlight Beach	Indicator Bacteria	Dry and Wet Weather
	Lower – San Marcos Creek	Eutrophic (nutrients)	Dry Weather
	Encinitas Creek	Toxicity	Dry Weather
	Upper – San Marcos Creek	Nutrients[2]	Dry and Wet Weather
	Upper – San Marcos Creek below Via Vera Cruz	Indicator Bacteria	Dry and Wet Weather
	San Marcos Lake[5]	Nutrients[2]	Dry and Wet Weather
Escondido Creek	Escondido Creek	Indicator Bacteria	Dry and Wet Weather
	Escondido Creek	Toxicity	Dry Weather
	Escondido Creek	Nutrients[2]	Dry and Wet Weather
	San Elijo Lagoon	Indicator Bacteria	Dry and Wet Weather
	San Elijo Lagoon	Sediment/Siltation	Dry and Wet Weather

[1] The use herein of the terms "pollutant(s)" and "pollution" should not be construed as an admission by the Responsible Agencies that the substances referenced herein constitute "pollutants" as that term is used in the context of liability insurance "pollution" exclusions as construed by California insurance law.

Hydrologic Area	Applicable Receiving Water	PWQC (pollutant or stressor)	Temporal Extent

1. Encinas HA does not have riparian habitat degradation as a priority water quality condition
2. Nutrients category includes at least two or more of the following pollutants: Dissolved phosphorus, Orthophosphate, Total phosphorus, Total Kjeldahl Nitrogen, Total Nitrogen, Eutrophication, or Benthic Algae
3. Available data were collected by CDPH for the protection of public health related to commercial shellfish harvesting in the Lagoon. CDPH water quality benchmarks are established by the National Shellfish Sanitation Program and exist for fecal coliform only. These data were the basis for the evaluation. However, the Water Quality Control Plan for the San Diego Basin establishes a water quality objective for total coliform, for which no data exists. Due to this conflict and identified data gap, the pollutant is listed as fecal indicator bacteria, rather than a specific indicator.
4. Data was collected by CDPH throughout the Lagoon for the protection of public health related to commercial shellfish harvesting. CDPH water quality benchmarks are established by the National Shellfish Sanitation Program and exist for fecal coliform only. In the absence of other information, these fecal coliform data were the basis for the REC-1 evaluation. However, the Bacteria Provisions adopted by the State Water Resources Control Board establish water quality objectives for enterococcus only in saline waters (e.g., lagoons, ocean), for which no recent data exists in the Lagoon. The evaluation of fecal coliform data does not indicate impairments to REC-1 in the Lagoon. However, due to concerns from the public and the RB, the condition was elevated to a priority. Consistent with the most recent statewide policy, monitoring will be performed for enterococcus, therefore the targeted pollutant is listed as such.
5. The Citizens Development Corporation privately owns San Marcos Lake

Table 3: Carlsbad WMA WQIP Highest Priority Water Quality Conditions

Hydrologic Area	Applicable Receiving Water	HPWQC (pollutant or stressor)	Temporal Extent
Loma Alta	Loma Alta Slough	Eutrophic (nutrients)	Between May and October
Buena Vista Creek	Buena Vista Lagoon	No HPWQC	NA
Agua Hedionda	Agua Hedionda Creek	Riparian Habitat Degradation (various)	Wet and Dry Weather
Agua Hedionda	Agua Hedionda Creek	Hydromodification Impacts (various)	Wet and Dry Weather
Encinas	Pacific Ocean	No HPWQC	NA
San Marcos	Lower – Pacific Ocean Shoreline at Moonlight Beach	Impairment of REC-1 (Indicator Bacteria)	Wet and Dry Weather
San Marcos	Upper – San Marcos Creek	Eutrophic (nutrients)	Wet and Dry Weather
Escondido Creek	Escondido Creek	Riparian Habitat Degradation (various)	Wet and Dry Weather

HPWQC = Highest Priority Water Quality Condition; NA = Not Applicable; REC-1 = water contact recreation beneficial use

Numeric goals and schedules were established for each HPWQC, and strategy implementation is intended to achieve the identified goals. Specific information on the goals, schedules, and progress for each HA is included in Section 3 of this annual report.

3 Water Quality Improvement Goals, Schedules, and Strategies

This section summarizes the progress toward achieving the interim and final numeric goals and strategy implementation for the HPWQCs within the applicable HAs of the Carlsbad WMA during the reporting period. Identifying goals and the means to achieve them is a fundamental component of the WQIP. The goals, strategies, and schedules were established through the WQIP development process, and details are included in the current WQIP (September 2021).

The RAs implement strategies as part of their JRMPs and WQIP(s). A compilation of JRMP Annual Report data for FY23 is provided in Appendix C, demonstrating the collective efforts for jurisdictional implementation throughout the WMA. Thirteen strategies (i.e., core strategies) represent JRMP activities required by the MS4 permit, while other strategies have been identified to support progress toward WQIP goals. All strategies aim to protect, preserve, enhance, or restore water quality and designated beneficial uses of waterways within each HA. While some strategies focus on specific sources and stressors that potentially contribute to the HPWQC and PWQCs, others are more general and provide multiple water quality benefits. This multi-benefit approach is essential to maintaining and improving overall WMA health. These strategies and efforts are implemented on a regional, watershed, or jurisdictional scale, and implementation of these strategies during the reporting period is presented in Appendix D.

Over $19.8 million in RA program implementation expenditures were reported in FY23 by agencies in the Carlsbad WMA to improve water quality. This total expenditure includes funding for implementing over 70 strategies throughout the WMA, which contribute to improving or protecting water quality. The expenditures include jurisdictional program implementation, which, when combined as a watershed, resulted in the following outcomes[2]:

- 1,952 investigations of non-storm water discharges conducted
- 1,459 non-storm water discharges eliminated
- 1,299 illicit discharges/connections eliminated
- 7,615 construction site inspections
- 4,932 existing development inspections
- 3,017 tons of debris removed from MS4 structures and facilities
- 5,494 tons of debris removed through street sweeping efforts
- 1,617 high priority development structural BMP inspections
- 104 public outreach events conducted

The RAs also participated in several regional efforts to improve water quality in the Carlsbad WMA (Appendix D). For example, RAs improved the Project Clean Water website to increase educational resources, promoted the “52 Ways to Love Your Water” pledge to spread storm water awareness, and sponsored several I Love a Clean San Diego clean-up events. Clean-up events resulted in the removal of over 21,043 pounds of trash and recyclables in the Carlsbad WMA and approximately 76,980 pounds region wide.

The following sub-sections present the upcoming interim and final goals and progress toward goals for each HA. Monitoring performed as part of the goal progress assessment is presented, and each sub-section concludes with strategy implementation highlights to address the respective HPWQC.

[2] Key highlights of jurisdictional implementation activities presented is not a comprehensive list of implementation outcomes.

3.1 Loma Alta Hydrologic Area

The HPWQC for the Loma Alta HA[3] (Figure 4) is eutrophic conditions in the Loma Alta Slough between May and October. The interim and final goals, progress toward those goals, and strategy highlights are presented in the following sub-sections.

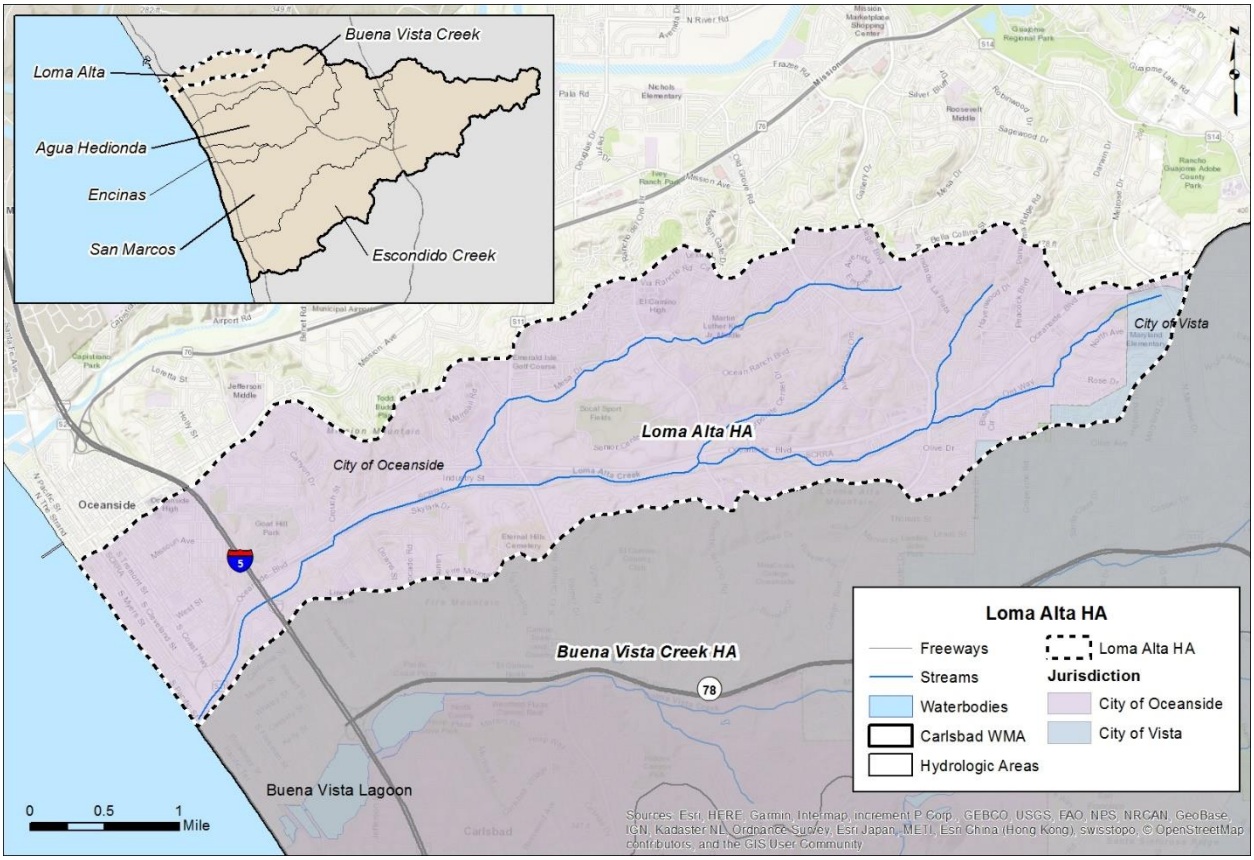

Figure 4: Loma Alta Hydrologic Area

3.1.1 Goal Progress

The numeric goals for Loma Alta HA are based on macroalgal biomass (grams dry weight per cubic meter – g dw/m3) and macroalgal cover (percent cover) conditions in Loma Alta Slough from May through October. The interim and final goals to address HPWQCs in the Loma Alta HA and the progress toward goals are presented in Table 4.

Results from the *Long-Term Water Quality Monitoring at Loma Alta Slough Monitoring Program* (Weston Solutions, 2022) confirm the successful attainment of both interim and final numeric goals, see Attachment 1 of the FY22 Carlsbad WQIP Annual Report. Furthermore, the results for 2022 show the lowest macroalgal biomass and percent cover measured in the entire history of the monitoring program. This reduction in biomass has been a consistent trend since 2017, demonstrating statistically-significant decrease. Figure 5 and Figure 6 below compare results from the monitoring years 2016 through 2022 to interim and final goals. These figures illustrate that both macroalgal cover and macroalgal biomass goals have been consistently met since 2016 and 2019, respectively. The 2022 summer monitoring period was the final year of monitoring required under Resolution No. R9-2014-0020. This resolution required the

[3] The County of San Diego is no longer a RA in the Loma Alta HA. The two parcels within the unincorporated area were annexed to the City of Vista during the reporting period.

incorporation of Loma Alta Slough's final numeric targets into the Carlsbad WQIP and for monitoring to be conducted from 2016-2022.

During the FY23 reporting period, the City of Oceanside confirmed with the RWQCB that the monitoring program was completed after the 2022 sampling period, as both final numeric goals were met and the monitoring period specified in the Resolution has ended.

Table 4: Loma Alta HA Progress toward Interim and Final Goals

Numeric Goals		Baseline	Reporting Period Results	Goal Achieved or In Progress?
Summer-Dry Season Between May and October (City of Oceanside)				
2021 Interim Goal	*Macroalgal Biomass less than 350g dry wt./m^3*	*Interim Macroalgal biomass and percent cover reduction goals are currently based on best professional judgment and historical data in Loma Alta Slough, as a reliable baseline of macroalgae data was not available at the time of RWQCB acceptance of the WQIP. The goals may be adapted as monitoring data/information is collected, analyzed, and baselines are established. Final Numeric Goals reflect those accepted by the RWQCB and described in the draft TMDL report and reiterated in RWQCB Resolution No. R9-2014-0020.*	*42.87 g dw/m^3*	***Achieved[1]***
	Macroalgal cover less than 65%		25%	***Achieved[1]***
2023 Final Goal	*Macroalgal Biomass less than 90g dry wt./m^3*		*23.11g dw/m^3*	***Achieved***
	Macroalgal cover less than 50%		*22%*	***Achieved***

Shaded italicized text denotes the selected compliance method to demonstrate progress for the interim goal.

[1] Currently being achieved. Per Resolution R9-2014-0020, the City was to conduct monitoring for seven years concluding in the 2022. The final numeric goals have been met. The City of Oceanside will work with RWQCB staff in FY24 to identify a new HPWQC in the Carlsbad WMA through the adaptive management process outlined in Provision B of the MS4 Permit.

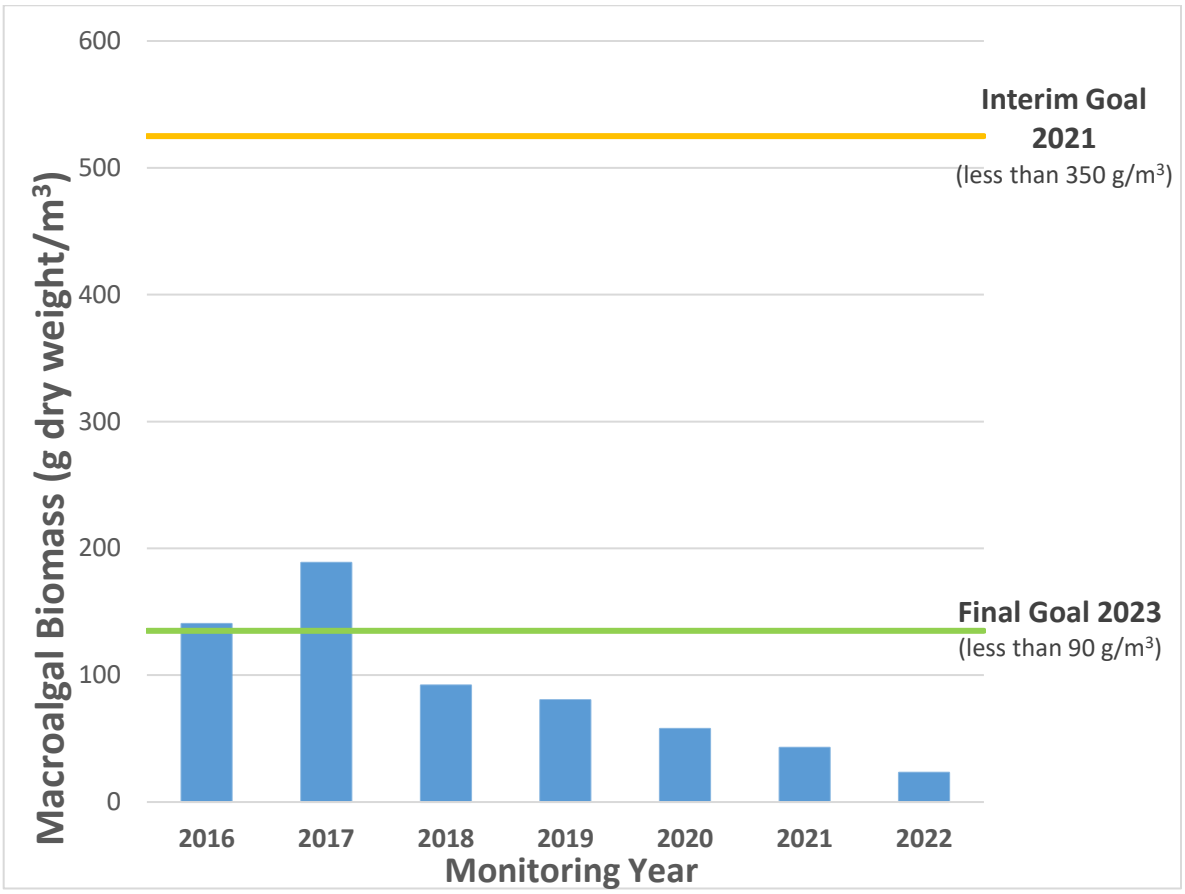

Figure 5: Loma Alta Slough Progress toward Macroalgal Cover Goals

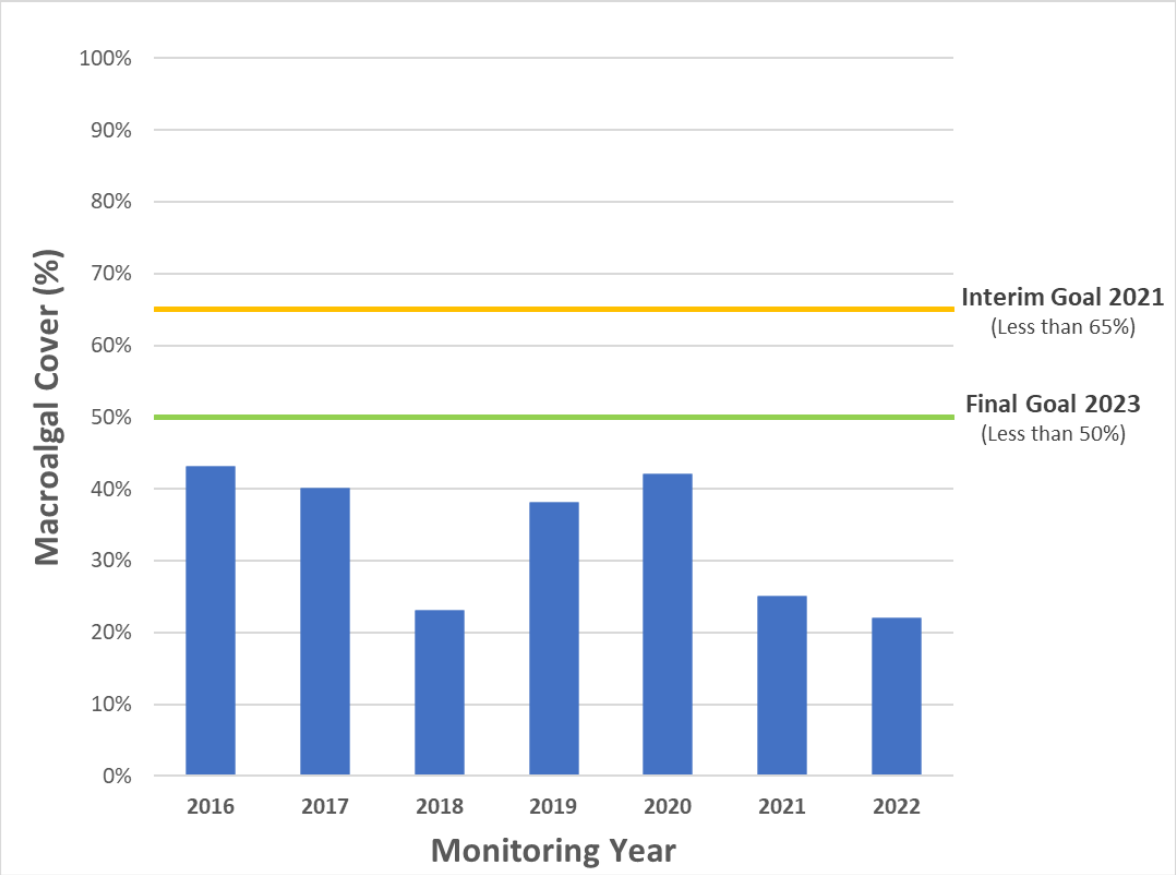

Figure 6: Loma Alta Slough Progress toward Macroalgal Biomass Goals

3.1.2 Hydrologic Area Strategy Highlights

Strategies to highlight in the Loma Alta HA include the Loma Alta Slough Wetlands Enhancement Project and Garrison Creek Native Habitat Restoration Project strategies. As discussed below, both strategies are restoration efforts aimed to achieve multiple benefits including habitat enhancement, flood protection, water quality improvements, preservation of open space, and enhancing recreational opportunities. For additional strategies implemented in the HA during the reporting period, refer to Appendix D.

Figure 7: Loma Alta Slough

Loma Alta Slough Wetland Enhancement Project

The Loma Alta Slough Wetlands Enhancement Project addresses the priority eutrophic water quality condition at Loma Alta Slough and aims to achieve multiple benefits through the restoration of ecological functions and protection of infrastructure from future climate-driven impacts. The project has existed in a conceptual phase for years as the City of Oceanside worked to acquire private properties surrounding the Slough beginning in the 1990s. In 2018, the city was awarded a Proposition 1 planning grant from the

Figure 8: Loma Alta Slough

State Coastal Conservancy to complete the required studies, preliminary design, and environmental documentation for a comprehensive restoration project. The project enhances the hydrologic function and habitat quality of existing coastal salt marsh and brackish freshwater wetlands by removing invasive species, dredging new wetland areas, and removing non-native infill to widen the extent of Loma Alta Slough. The restoration improves the existing habitat by enhancing water circulation and establishing new habitat ecotones to provide refuge for sensitive coastal species. Of the total six-acre project footprint, the restoration creates an additional three acres of new wetlands at the Slough, which will play an important role in nutrient reduction by removing nitrogen and phosphorus while providing infrastructure protection from increased storm intensity and sea-level rise from expected climate change. The project design is taking a multi-benefit approach, balancing the need for water quality improvements with flood risk reduction, coastal infrastructure protection, and recreational opportunities through the inclusion of a trail system.

During the FY23 reporting period, substantial progress was made in readying the project for construction. In addition to prior committed construction funding of $1M from the US Fish & Wildlife Service, the Ocean Protection Council awarded an additional over $1M in June 2022. The following was achieved in the FY23 reporting period:

- Acquisition of three major agency permits required for construction, including a CDFW Streambed Alteration agreement, RWQCB 401 water quality certification, and Coastal Commission Development Permit;
- Finalized the project's 90% engineering plan set and began the City's internal entitlement process to approve a Discretionary Development Plan for the area;
- Coordinated project construction with three other major CIP projects surrounding the restoration footprint, which includes trail connections to a future extension of the Coastal Rail Trail through south Oceanside; and
- City Council certification of the project's Final CEQA Documentation, including adoption of the Mitigated Negative Declaration, Mitigation Plan and Notice of Determination

The city expects the final Construction Documents to be completed in late 2023. Pending final regulatory approvals and sufficient construction funding, the City expects to put the project out to bid in early 2024, with Phase 1 construction planned for late 2024. Implementation depends entirely on available grant funding, as concerns persist that inflationary and economic pressures have increased the estimated costs for Phase 1.

Figure 9: Graphic rendering of Phase 1 of the Loma Alta Wetlands Enhancement Project (ESA 2023).

Figure 10: Loma Alta Slough Wetlands

The city is coordinating the Enhancement Project construction with three important infrastructure projects in the vicinity of Loma Alta Slough, including the future decommissioning of the La Salina wastewater treatment plant, the Coastal Rail Trail extension southward over Loma Alta Creek, and future

upgrades to Buccaneer Park. Completing these projects is synergistic as they will benefit one another by encouraging climate-friendly transit, restoring historical wetland habitats, and fostering public awareness of the value of open space creation and conservation.

Garrison Creek Native Habitat Restoration Project

Figure 11: Garrison Creek Native Habitat Restoration Project

In the FY23 reporting period, the City of Oceanside completed substantial work on the Garrison Creek Native Habitat Restoration Project. This project is a Supplemental Environmental Project (SEP), designed in cooperation with the RWQCB, to mitigate previous environmental impacts to the Loma Alta HA from a domestic sewage spill in 2015. The restoration work is intended to mitigate prior impacts to the Loma Alta tributary and enhance its biological and community value above its original condition. The project involves removing and controlling invasive vegetation within a 20-acre open space area of the Garrison Creek drainage and restoring over three acres of riparian forest and Diegan Coastal Sage Scrub habitat to benefit sensitive and threatened avian species. The project includes improvements to an existing public trail system with new interpretive signage to educate the community about the value of riparian habitat, restoration, and connectivity of watersheds and water quality in the Loma Alta HA.

During FY23, the city worked with its restoration partners, the Nature Collective and Friends of El Corazon, to conduct multiple invasive species treatments, installation of restoration irrigation, native plants, and broadcast seeding. The project is currently in Year 5 of the monitoring period and near achieving the success criteria for native habitat establishment and invasives control. As of the last vegetation monitoring event in July/August 2023, the restoration areas have increased to over 80% native species cover, well above the SEP restoration success criteria target of 65% native cover.

Figure 12. Garrison Creek Native Habitat Restoration Project:
Before and after photos of east restoration area between 2021 and early 2023

3.2 Agua Hedionda Hydrologic Area

The HPWQCs for the Agua Hedionda HA (Figure 13) are riparian habitat degradation and hydromodification impacts. The interim and final goals, progress toward those goals, and strategy highlights are presented in the following sub-sections.

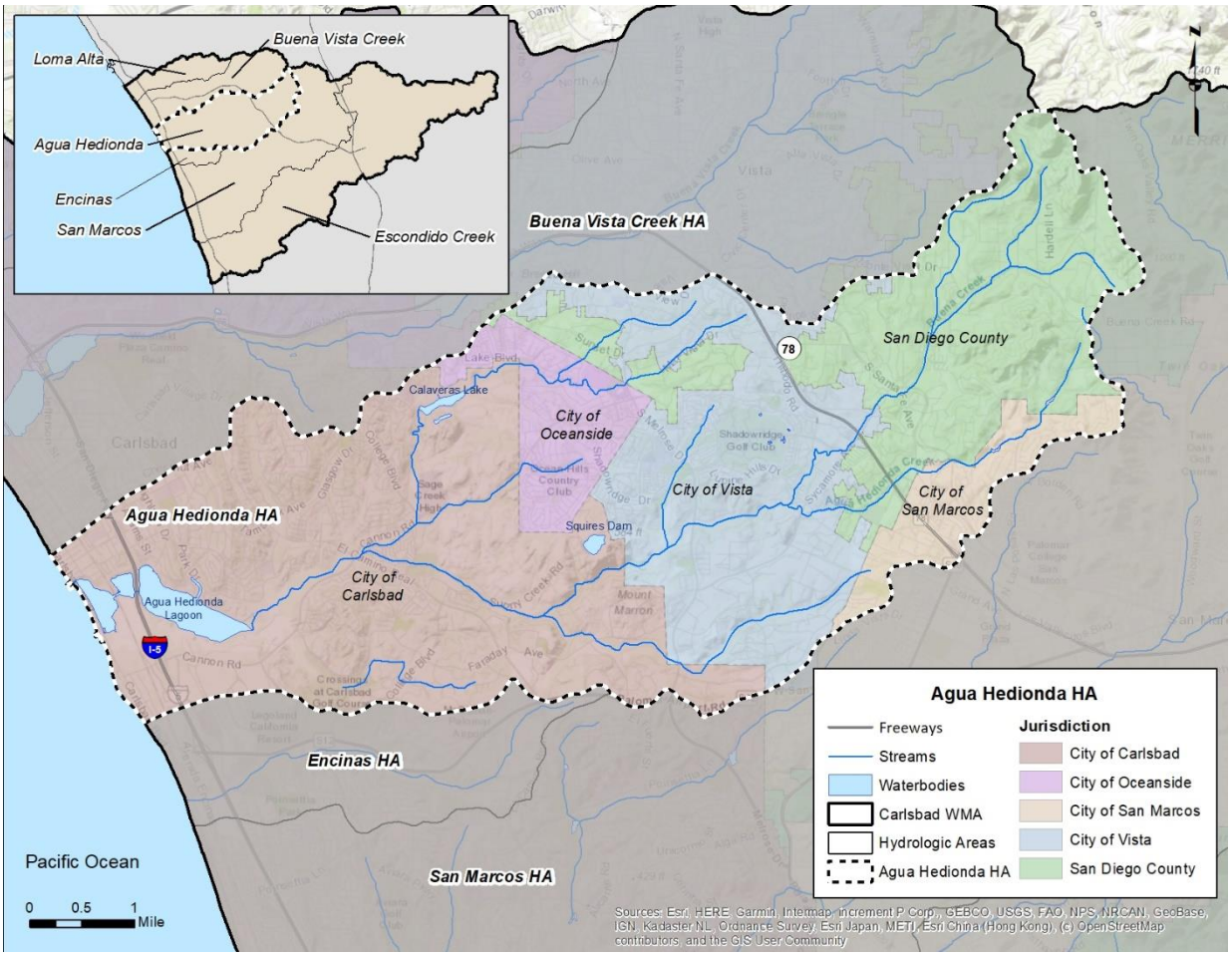

Figure 13: Agua Hedionda Hydrologic Area

3.2.1 Goal Progress

In the Agua Hedionda HA, restoration projects have been identified as goals to address riparian habitat degradation and hydromodification impact HPWQCs. Restoration of riparian habitats and other natural features supports healthy watersheds by providing critical habitat for wildlife, reducing creek bank erosion, maintaining stable creek channel geomorphology, and enhancing natural processes to filter pollutants such as nutrients and sediment. In the Agua Hedionda HA, goal progress is based on advancing specific project implementation, as presented in Table 5.

Table 5: Agua Hedionda HA Progress toward Interim and Final Numeric Goals

Goals			Baseline	Reporting Period Results	Goal Achieved or In Progress?
Dry and Wet Weather (City of Carlsbad)					
Riparian Habitat Degradation	2023 Interim Goal (2018-2023)	*50% of the Agua Hedionda Creek Restoration project schedule complete*	*0% of Agua Hedionda Creek Restoration Project Completed*	*During the reporting period, the City of Carlsbad completed permitting for geotechnical work.*	***In Progress Not Achieved in 2023***
	2028 Final Goal (2023-2028)	Completion of Agua Hedionda Creek Restoration project (8.81 acres of mitigated riparian and upland habitat) and long-term preservation through the City of Carlsbad's Habitat Management Plan			In Progress
Dry and Wet Weather (City of Vista)					
Hydromodification Impacts	2023 Interim Goal (2020-2023)	50% of wetland creation completed adjacent to 700 feet of Roman Creek	*0% of wetland creation adjacent to Roman Creek*	*Solicitation of design-build services in FY 2021-22 resulted in a bid exceeding the project budget by over $2 million. The available budget for the project was carried forward in the CIP budget into FY 2022-23. The project remained on hold. The project status was discussed with the Regional Board staff. The city initiated a review of alternative hydromodification characteristics and activities.*	***In Progress Not Achieved in 2023***
	2026 Final Goal (2023-2026)	Completion/creation of approximate 2-acre wetlands adjacent to Roman Creek in the City of Vista's Buena Vista Park area			In Progress

Shaded italicized text denotes the selected compliance method to demonstrate progress for the interim goal.

3.2.2 Numeric Goal Strategy Highlights

Strategies to highlight in the Agua Hedionda HA include the Roman Creek Wetland Restoration Project, Agua Hedionda Creek Restoration Project, and other efforts that address riparian habitat degradation and hydromodification impacts. For further details and additional strategies implemented in the HA during the reporting period, refer to Appendix D.

Agua Hedionda Creek Restoration Project

The City of Carlsbad's Agua Hedionda Creek Restoration Project focuses on restoring riparian habitat areas to improve flood control, reduce erosion, stabilize riverbanks, increase habitat connectivity and quality, and improve water quality.

In FY17, Carlsbad met its goal by restoring 3.6 acres of wetland habitat near Agua Hedionda Creek and removing invasive species. In FY22, the city completed its fifth year of vegetation maintenance.

Figure 14: Portion of Agua Hedionda Creek

The city is in progress toward achieving the next interim goal (2023) and final goal (2028), as identified in Table 5. In FY22, the City of Carlsbad awarded a $1,919,294 contract to support the extension of College Boulevard to the east of El Camino Real at Sunny Creek Road. The extension of College Boulevard is a long-term project, and creek restoration is planned to be completed as part of the project. Tasks to be completed through the issued contract include, but are not limited to:

- Surveying
- Preliminary environmental impact and mitigation assessment
- Preliminary hydraulic and hydrological studies
- Preliminary geotechnical engineering investigation
- Preliminary civil engineering plans
- Preliminary storm water quality management plan
- Preliminary construction cost estimates
- Community outreach program

In FY22, the city completed the traffic mobility analysis, preliminary environmental field work and the preliminary hydraulics study. In FY23, the city continued execution of the consultant contract by completing the permits for the geotechnical work necessary for the engineering design. The city's Planning Department received preliminary cost estimates for discussions with relevant developers.

While progress toward creek restoration has occurred, the city recognizes that achieving the 2023 interim and 2028 final restoration goals is in jeopardy. Under the city's Growth Management Program, money from residential developer fees helps fund the infrastructure needed to support the corresponding increase in population. In the case of the College Boulevard extension, most of the adjacent properties don't have active development plans, and not all landowners in the area are planning to develop soon, leading to a lack of funding and a delay of the overall project.

Although the Agua Hedionda Creek Restoration Project is delayed, and the final construction timeline is unknown, the city has been actively implementing programmatic strategies within the Agua Hedionda HA that have similar water quality benefits as creek restoration. Attachment 2 of the FY22 CWMA WQIP Annual Report summarizes the city's overall efforts.

In recognition of not achieving the 2023 Interim Goal, during FY24 the city will initiate an adaptive management process to reconsider the HPWQC and existing numeric goals. This process will involve close collaboration with the RWQCB, a reevaluation of priority water quality conditions, hydrologic area

characteristics, and the potential development of revised numeric interim and final goals. Subsequent annual reports will provide updates on the city's progress.

Roman Creek Wetland Restoration Project

Roman Creek is tributary to Agua Hedionda Creek and flows through Buena Vista Park (Figure 13). The Roman Creek Wetland Restoration Project is identified in the Carlsbad WMA WQIP as a strategy for wetland creation and enhancement to address hydromodification impacts and as a mitigation strategy to compensate for aquatic resource impacts from other city projects. Previous Carlsbad WMA annual reports detail field studies, design efforts, and environmental permitting activities associated with the Roman Creek project. To date, the city has expended $1,136,000 on the project.

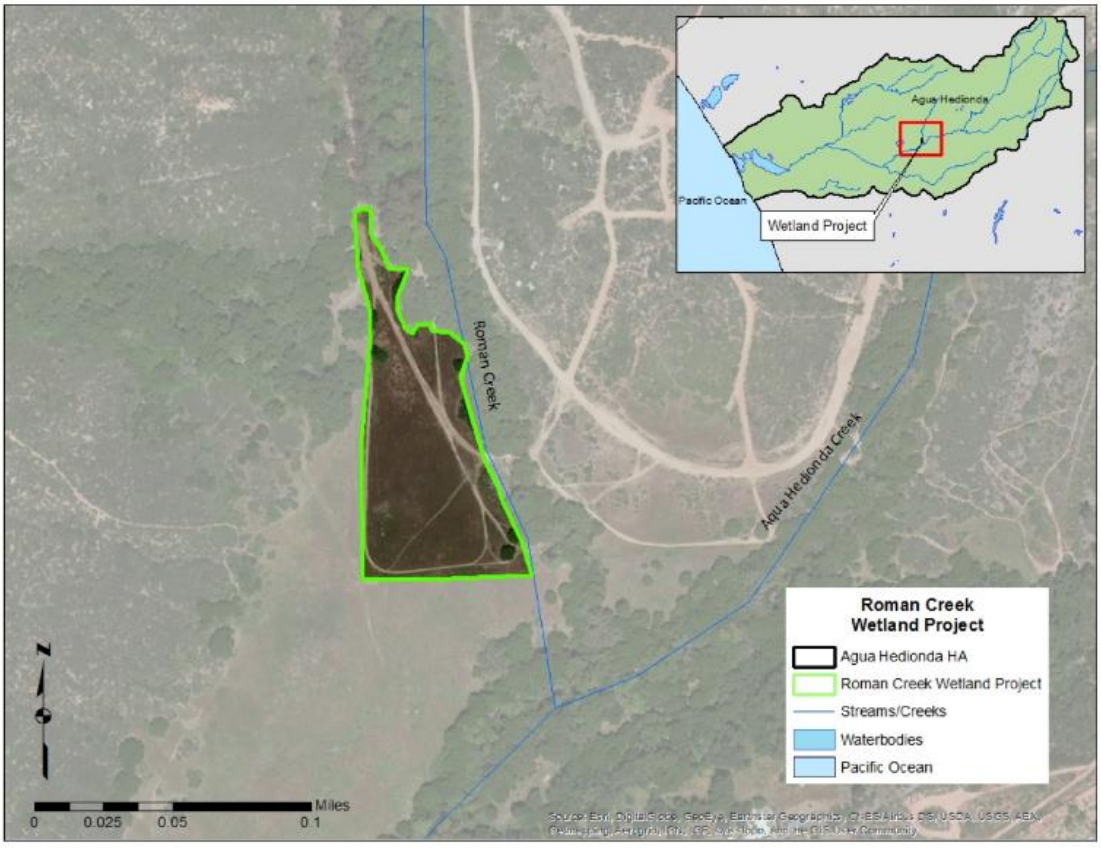

Figure 15: Roman Creek Wetland Restoration Project Location

As previously reported, a request for proposals (RFP) was released in September 2021, soliciting design-build services for the Roman Creek project. The RFP detailed the full scope of services to design and construct the project to accomplish the WQIP numeric goal. In October 2022, one bid of $6,000,000 was submitted, which, while deemed acceptable, surpassed the allocated budget by over $2,300,000.

Consequently, the city paused the project to consider value engineering options and evaluate funding during its Spring 2022 Capital Improvement Budget process. Based on the capital project needs for overall sewer system capacity and replacement projects, sufficient funds were unavailable to bridge the Roman Creek project funding gap. The city recognizes that achieving the 2023 interim and 2026 final wetland creation goals is in the balance.

During FY23, the city explored alternative actions that could provide similar benefits to the Roman Creek project. Unfortunately, within the area tributary to Roman Creek, opportunities for retrofit projects or new developments with comparable benefits are limited. The area is relatively small, fully developed, and

home to significant homeowner associations where redevelopment is unlikely in the foreseeable future. However, the city has identified a potential opportunity to expand the detention/retention capacity of a small basin upstream of the Roman Creek project site. While the benefits of this action are not yet quantified, the city is actively investigating its feasibility as a replacement for the Roman Creek project or, at the very least, as a complementary measure alongside adaptive management efforts related to High Priority Water Quality Control (HPWQC) and numeric goal adjustments.

In recognition of not achieving the 2023 Interim Goal, in FY23, the city initiated adaptive management efforts to reconsider the existing interim and final numeric goals. In FY24, this process will involve close collaboration with the RWQCB, a reevaluation of priority water quality conditions and hydrologic area characteristics, and the potential development of revised numeric interim and final goals. Subsequent annual reports will provide updates on the city's progress.

Program for Stream, Channel, and/or Existing Habitat Rehabilitation in Areas of Existing Development

Each RA developed rehabilitation programs as part of their jurisdictional programs to identify areas of streams, channels, and/or habitats that are candidates for rehabilitation and look for opportunities to implement projects. While all RAs implemented this program during FY23, the City of Carlsbad implemented a vegetation maintenance project in the Agua Hedionda HA to mitigate flooding impacts and protect riparian habitat.

Agua Hedionda Creek Vegetation Maintenance Project

Within the City of Carlsbad, long-term maintenance of Agua Hedionda Creek between the Cannon Road and El Camino Real bridges is necessary to reduce flooding upstream. To improve the creek's flood capacity, limited vegetation is permitted within this portion of the creek. This project is a five-year project per the CDFW Streambed Alteration Agreement (SAA) Notification No. 1600-2013-0302-R5. The permit was extended through 2024, and associated work was performed in October 2022 and February 2023. Creek vegetation maintenance is vital to support optimal creek conveyance capacities and flood protection benefits. Vegetation maintenance removes obstructions from the channel, maximizing the flow potential and reducing the risk of flooding upstream.

3.3 San Marcos Hydrologic Area

The San Marcos HA has two distinct areas separated by the Lake San Marcos impoundment – the Upper San Marcos and Lower San Marcos HAs (Figure 16). The Lower and Upper San Marcos HAs have different HPWQCs. The HPWQCs, interim and final goals, progress toward those goals, and strategy highlights for the Upper San Marcos HA and Lower San Marcos HA are presented in Section 3.3.1 and 3.3.2, respectively.

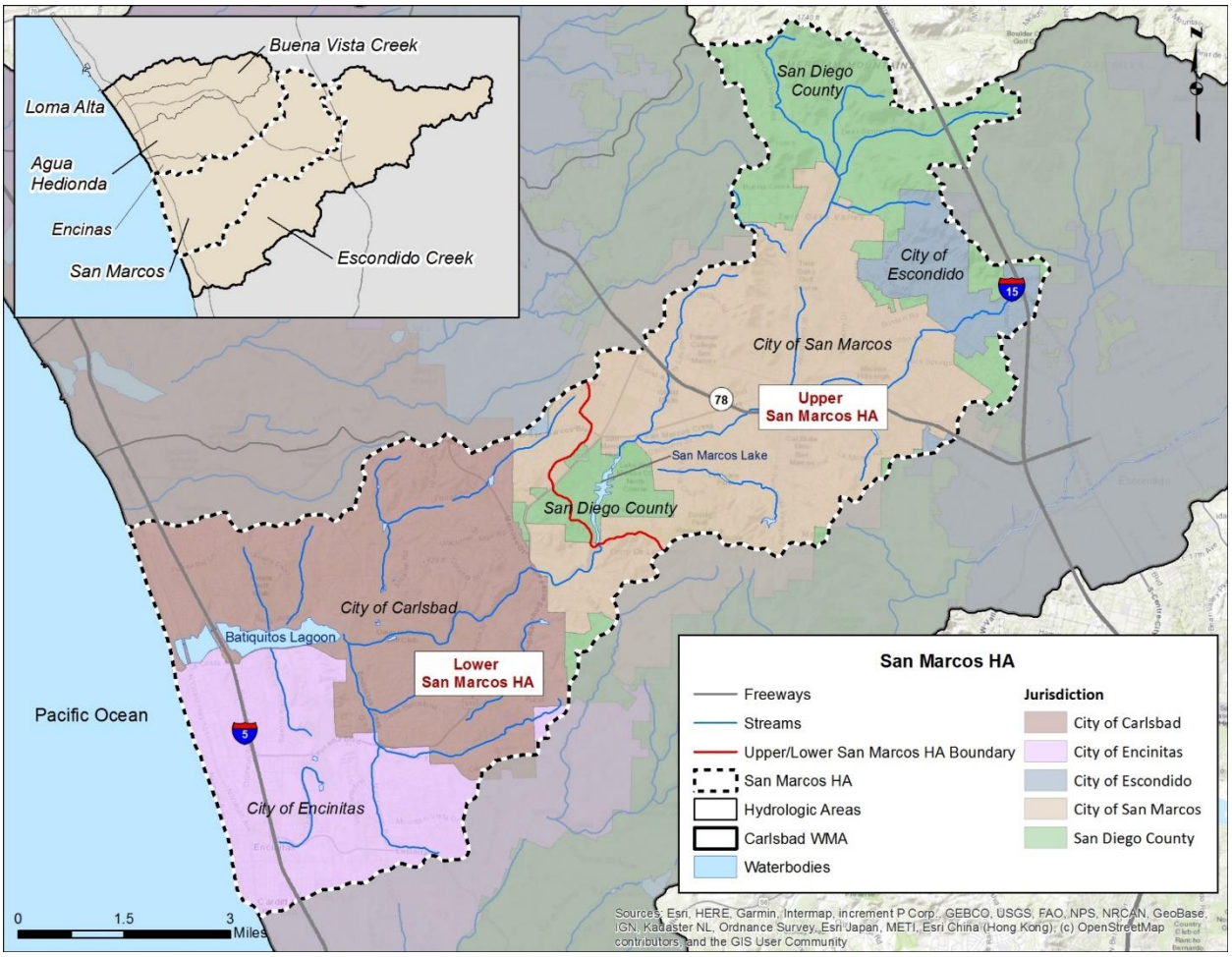

Figure 16: San Marcos Hydrologic Area

3.3.1 Lower San Marcos Hydrologic Area

The HPWQC for Lower San Marcos HA is the impairment of recreational (REC-1) beneficial use due to Fecal Indicator Bacteria (FIB) (i.e., total coliform, fecal coliform, and *Enterococcus*). Although Moonlight Beach has never been listed on the 303(d) list for REC-1 impairment, the beach continues to be monitored for compliance with the Twenty Beaches and Creeks TMDL. The interim and final goals (based on final receiving water limitations identified in the TMDL), progress toward goals, and strategy highlights are presented in the following sub-sections.

3.3.1.1 Goal Progress

Table 6: Lower San Marcos HA Progress toward Interim and Final Numeric Goals

Goals					Baseline	Reporting Period Results			Goal Achieved or In Progress?
Wet Weather (City of Encinitas)									
2021 Interim Goal (2018-2023)[1]	*Wet Weather Single Sample Maximum Allowable Exceedance Frequency (CFU/100mL)*[3]	*Interim Allowable Frequency*	*Total Coliform*	*40%*	*2002 Bacteria TMDL Modeling*	*Reporting Period Exceedance Frequency*	*Total Coliform*	*0%*	***Achieved***[4]
			Fecal Coliform	*40%*					
			Enterococcus	*41%*					
2028 Interim Goal[1] (2023-2028)			Total Coliform	31%			*Fecal Coliform*	*0%*	
			Fecal Coliform	31%					
			Enterococcus	32%					
2031 Final Goal[2] (2028-2033)		Final Allowable Frequency	Total Coliform	22%			*Enterococcus*	*19%*	
			Fecal Coliform	22%					
			Enterococcus	22%					
Dry Weather (City of Encinitas)									
2021 Final Goal[2] (2018-2021)	*Dry Season 30-Day Geometric Mean (CFU/100mL)* [3]	Final Allowable Frequency	Total Coliform	0%	*Calculations based on historical monitoring data from 1/1/1996 to 12/31/2002*	*Reporting Period Exceedance Frequency*	*Total Coliform*	*0%*	***Achieved***[4]
			Fecal Coliform	0%			*Fecal Coliform*	*0%*	
			Enterococcus	0%			*Enterococcus*	*0%*	
	Dry Season Single Sample Maximum Allowable Exceedance Frequency (CFU/100mL)[3]		Total Coliform	0%			*Total Coliform*	*0%*	***Achieved***[4]
			Fecal Coliform	0%			*Fecal Coliform*	*0%*	
			Enterococcus	0%			*Enterococcus*	*0%*	

Shaded italicized text denotes the compliance methods selected to demonstrate progress for the interim goal.

[1] MS4 Permit Attachment E compliance method 6.c.3.f. selected for this reporting period: No exceedances of interim receiving water limitations for bacteria (i.e., reduce the "existing" (2002) exceedance frequency of the 30-day geometric mean by 50%) in the Pacific Ocean downstream of the Moonlight Beach MS4 outfall. MS4 Permit Attachment E compliance methods 6.c.3.a, 6.c.3.b, 6.c.3.c., 6.c.3.d., 6.c.3.e., 6.c.3.g., and 6.c.3.h are not selected for this reporting period.

[2] MS4 Permit Attachment E compliance method 6.c.3.b. selected for this reporting period: No exceedances of final receiving water limitations for bacteria in the Pacific Ocean, at or downstream of the Moonlight Beach MS4 outfall. MS4 Permit Attachment E compliance methods 6.c.3.a, 6.c.3.c, 6.c.3.d., 6.c.3.e., 6.c.3.f., 6.c.3.g., and 6.c.3.h are not selected for this reporting period.

[3] During dry weather days, the single sample maximum and 30-day geometric mean receiving water limitations are required to be achieved.

[4] Currently being achieved. Monitoring will continue to determine if goal achievement is maintained.

3.3.1.2 Highest Priority Water Quality Condition Strategy Highlights

Strategies highlighted in this section include the ultraviolet (UV) bacteria treatment facility strategy, evaluation of the sanitary sewer maintenance and overflow protection strategy, and the pet waste bag dispensers strategy. These strategies target FIB reductions through treatment and source control and support progress toward interim and final goals. For additional strategies implemented in the Lower San Marcos Creek portion of the HA during the reporting period, refer to Appendix D.

Evaluate Sanitary Sewer Maintenance and Overflow Prevention

Evaluation of sanitary sewer maintenance and overflow protection targets anthropogenic sources of FIB and contribute to decreased FIB levels in the Lower San Marcos HA. The City of Encinitas has an annual sewer line maintenance schedule. The city utilizes a "hot-spot" cleaning list for observed or documented sewer line anomalies such as low flows, dips, or historic root problems. Encinitas maintains a 5-year closed-circuit television (CCTV) inspection cycle for all sewer lines throughout the city. Sewer spill records and a holistic assessment of the city's sewer system maintenance program have concluded that there is no need for a change in maintenance frequency or FOG program policies at this time.

Ultraviolet Bacteria Treatment Facility

The City of Encinitas operates a UV treatment facility just upstream of Moonlight Beach, eliminating 99% of the FIB passing through the system. The city has an administrative agreement with the San Elijo Joint Powers Authority (SEJPA) to perform preventative and regular UV treatment facility maintenance, including daily monitoring, inspections, and startup and shutdown of the facility as dictated by rain events.

Figure 17. Cottonwood Creek Downstream of UV Treatment Facility

In FY23, the facility was non-operational through continuous rain events beginning late December 2022 through mid-April 2023, as well as for short periods during other rain events throughout the reporting year. Despite observed winter rainfalls that nearly doubled historical annual averages, the facility was in operation for 214 days during the monitoring period. The daily average volume of water that passes through the UV treatment facility is approximately 144,000 gallons per day, which resulted in the treatment of an estimated 30.8 million gallons of flow during the reporting period.

Riparian habitat along Cottonwood Creek downstream of the UV treatment facility is illustrated in Figure 17 above.

Pet Waste Bag Dispensers

If left on the ground, pet waste can be a source of bacteria in receiving waters. During the reporting period, the City of Encinitas, the City of Carlsbad, and the County of San Diego continued to encourage and promote proper pick-up and disposal of pet waste by providing pet waste bag dispensers in public areas, including city parks and trails.

3.3.2 Upper San Marcos Hydrologic Area

The HPWQC for the Upper San Marcos HA is nutrients. The interim and final goals, progress toward the goals, and strategy highlights are presented in the following sub-sections.

3.3.2.1 Goal Progress

The interim and final goals for the Upper San Marcos HA are presented below in the narrative and summarized in Table 7 on the following pages. The detailed monitoring and assessment results are presented in the Upper San Marcos Creek HA 2022-2023 Monitoring Report (Attachment 2) and MS4 Outfall Monitoring Report (Attachment 3).

3.3.2.2 Numeric Goal Strategy Highlights

The following are numeric goal strategy highlights in the Upper San Marcos HA:

Enhanced Agricultural Facility Inspections in the Upper San Marcos HA.

During FY23, there was a total of 84 inventoried commercial agricultural facilities within the USMC HA. The Responsible Agencies conducted 147 on-site inspections at these facilities. 76 inspections were conducted at sites ranked as high TTWQ, and 71 were conducted at medium TTWQ sites.

There were no sites ranked as low TTWQ. Sites not inspected during FY22-23 are scheduled to be inspected in FY23-24. Of the 84 inventoried facilities, 83 have received at least one inspection since July 2021.

Enhanced Golf Course Inspections in the Upper San Marcos HA.

The Responsible Agencies inspected all three inventoried golf courses in FY23. One site had violations related to routine maintenance. All violations were resolved, and corrective actions were completed within 30 days.

HOA Outreach

In FY23, eight of twenty-two (36%) identified HOAs were provided outreach on the County's Waterscape Rebate Program. Outreach included phone calls, emails, and/or in person meetings. Six HOAs are participating in the Program's Landscape Optimization Service where each HOA has committed to converting at least 10,000 sf of turf grass to sustainable landscaping.

Fairways HOA Retrofit Pilot Project

In FY19-20, the County initiated a partnership with The Fairways HOA in the Lake San Marcos area (MS4-CAR-072 Drainage/Focus Area) with the goal of establishing a pilot demonstration project for the County's Waterscape Rebate Program. The pilot project included replacing old irrigation controllers with smart weather-based irrigation controllers. The HOA installed four new controllers that operate 136 stations and completed nozzle upgrades. Five years (June 2018 through June 2023) of water usage data collected from four dedicated irrigation meters at The Fairways HOA indicate an approximately 36% decrease in water usage since completing the project. It should be noted that there was a 53.07% dry weather flow reduction measured at Outfall MS4-CAR-072 during the 2022-2023 monitoring year.

After completion of the pilot project, the HOA also replaced approximately 23,000 square feet of turf with sustainable landscaping, including 10,000 square feet with native plants, as shown in the images below.

Septic System Outreach.

Based on available data, the Responsible Agencies have identified 53 residences and businesses that are likely on septic systems. A total of 26 of the 53 (49%) identified residences and businesses received outreach consisting of mailed letters and fliers.

For additional strategies implemented in the HA during the reporting period, refer to Appendix D.

Figure 18 – Fairways HOA Turf Replacement Project - Before

Figure 19 – Fairways HOA Turf Replacement Project - After

Table 7: Upper San Marcos HA Progress toward Interim and Final Numeric Goals – Wet Weather

Goals		Baseline	Reporting Period Results			Goal Achieved or In Progress?
City of San Marcos, City of Escondido, and County of San Diego						
2023 Interim Goal (2018-2023)	*10% nutrient load reduction from baseline OR*	*Total Nitrogen = 88,904 lbs./year[1]* *Total Phosphorus = 6,867 lbs./year[1]*	*Total Nitrogen*	*5,153lbs./yr*	*94.22% load reduction*	***Achieved[2]***
			Total Phosphorus	*656 lbs./yr*	*90.4.9% load reduction*	
	Meet nutrient water quality objectives[3].	Not applicable – This compliance method not selected	Not applicable – This compliance method not selected			N/A
2028 Interim Goal (2023-2028)	20% nutrient load reduction from baseline OR	Total Nitrogen = 88,904 lbs./year[1] Total Phosphorus = 6,867 lbs./year[1]	Total Nitrogen	5,153 lbs./yr	94.2% load reduction	**Achieved[2]**
			Total Phosphorus	656 lbs./yr	90.4.9% load reduction	
	Meet nutrient water quality objectives[3].	Not applicable – This compliance method not selected	Not applicable – This compliance method not selected			N/A
2033 Final Goal (2028-2033)	40% load reduction from baseline OR	Total Nitrogen = 88,904 lbs./year[1] Total Phosphorus = 6,867 lbs./year[1]	Total Nitrogen	5,153 lbs./yr	94.2% load reduction	**Achieved[2]**
			Total Phosphorus	656 lbs./yr	90.4.9% load reduction	
	Meet nutrient water quality objectives[3].	Not applicable – This compliance method not selected	Not applicable – This compliance method not selected			N/A

Shaded italicized text denotes the selected compliance method to demonstrate progress for the interim goal.

[1] The baseline value represents the 2010-2011 wet weather load.

[2] Currently being achieved. Monitoring will continue to determine if goal achievement is maintained.

[3] WQO for nutrients: In a creek just before entering a standing body of water = 0.05 mg/L Total Phosphorus and 0.5 mg/L Total Nitrogen. In the future, site-specific WQO may be developed

Table 8: Upper San Marcos HA Progress toward Interim and Final Numeric Goals – Dry Weather

Goals		Baseline	Reporting Period Results	Goal Achieved or In Progress?
City of San Marcos, County of San Diego[1]				
2023 Interim Goal (2018-2023)	Effectively eliminate 20% of the dry weather flow[2] from identified outfall(s) OR	Total Discharge: 13,746,581 gallons[3]	Not applicable – This compliance method not selected	N/A
	Effectively eliminate two persistently flowing outfalls OR	Not applicable – This compliance method not selected	Not applicable – This compliance method not selected	N/A
	Dry weather flow from identified outfalls meets the nutrient WQO[4] for the applicable water body segment. OR	Not applicable – This compliance method not selected	Not applicable – This compliance method not selected	N/A
	Address all items below: • *Inspect high threat to water quality (TTWQ) agricultural facilities annually and inspect all other (i.e., medium and low TTWQ) inventoried agricultural facilities at least once every five years. AND* • *Inspect all inventoried golf courses once every two years. AND* • *Conduct outreach to 10% of identified HOAs and completion of the Fairways HOA Retrofit Pilot Project. AND* • *10% of identified residences and businesses on septic systems receive outreach.*	• *Inspect all inventoried facilities once every five years per MS4 Permit Provision E.5.c.(1).* • *Minimal to no outreach to HOAs regarding incentive and rebate programs.* • *Residences and businesses on septic systems receive outreach on proper use and maintenance as needed (0% of residences and businesses receive outreach). No Septic System Pump-out Rebate Program is offered.*	*See narrative in Section 3.3.2.2 above.*	***Achieved***
2028 Final Goal (2023-2028)	Effectively eliminate 40% of the dry weather flow[2] from identified outfall(s). OR	Total Discharge: 13,746,581 gallons[3]	Not applicable – This compliance method not selected	N/A
	Dry weather flow from identified outfalls meets the nutrient WQO[4] for the applicable water body segment. OR	Not applicable – This compliance method not selected	Not applicable – This compliance method not selected	N/A
	Address all items below: • Inspect all high TTWQ agricultural facilities at least once per year and up to four times annually, depending on compliance history. Inspect medium TTWQ inventoried agricultural facilities at least once every two years and low TTWQ inventoried agricultural facilities at least once every five years. AND • Inspect all inventoried golf courses once every two years. AND • Conduct outreach to 20% of identified HOAs and implementation of additional incentive and rebate programs where opportunities arise. AND • 20% of identified residences and businesses on septic systems receive outreach. • Implement a Septic System Pump-out Rebate Program offered on first come first served basis to partially offset the cost of septic system pumping.	• Inspect all inventoried facilities once every five years per MS4 Permit Provision E.5.c.(1). • Minimal to no outreach to HOAs regarding incentive and rebate programs. • Residences and businesses on septic systems receive outreach on proper use and maintenance as needed (0% of residences and businesses receive outreach). No Septic System Pump-out Rebate Program is offered.	N/A	In Progress

Shaded italicized text denotes the selected compliance method to demonstrate progress for the interim goal.

[1] The City of Escondido has not identified any major MS4 outfalls within its portion of the watershed.

[2] Dry weather flow includes all non-storm water discharges from an outfall including exempt or permitted non-storm water discharges in accordance with the MS4 Permit.

[3] Value is the sum of the 2016-2017 baseline total flows (includes anthropogenic and non-anthropogenic flows) calculated for each of the outfalls that were monitored in 2022-2023. Outfall baseline calculations are presented in the 2022-2023 Upper San Marcos Creek HA Monitoring Report (Attachment 2 of this annual report) and in the Upper San Marcos Creek HA Preliminary Monitoring Plan available at http://www.projectcleanwater.org/download/carlsbad-wma- monitoring-plans/.

[4] WQO for nutrients: In a creek = 0.1 mg/L Total Phosphorus and 1.0 mg/L Total Nitrogen; in a creek just before it enters a standing body of water = 0.05 mg/L Total Phosphorus and 0.5 mg/L Total Nitrogen; standing body of water = 0.025 mg/L Total Phosphorus and 0.25 mg/L Total Nitrogen.

3.3.2.3 Highest Priority Water Quality Condition Strategy Highlights

Figure 20: Example of New Green Street BMPs at the Villages Redevelopment Project

Implement Preferred Watershed Remedy as Proposed through the Final Corrective Action Plan

The City of San Marcos, the County of San Diego, and the City of Escondido continue to move forward with the preferred watershed remedies recommended in the Final Remedial Investigation/Feasibility Study (RI/FS) for the Upper San Marcos Creek HA. Table 9 summarizes the completed activities during this reporting period. A description of the various completed activities is detailed in Appendix D. All data and documentation related to the Lake San Marcos and Upper San Marcos Creek Water Quality Investigation can be viewed and obtained at the State of California GeoTracker website[4].

Table 9: FY23 RI/FS Efforts Conducted

Date	Item and Comments
December 30, 2022	**Lake San Marcos 2022 Aeration Pilot Study Report** – submitted to San Diego RWQCB.
March 14, 2023	**Lake San Marcos Bridge Document Draft 2 March 2023** – submitted to San Diego RWQCB.

Escondido Country Club Redevelopment and Runoff Treatment Project

The Escondido Country Club golf course in the City of Escondido was closed and rezoned for residential development. The former golf course property is being redeveloped into a residential master-planned community known as Canopy Grove. The Canopy Grove project site encompasses 97.5 acres and will have structural biofiltration BMPs to treat runoff (Figure 21). The City of Escondido's development agreement negotiated in FY18 requires the developer to treat over 100 acres of existing neighborhoods outside the project site. In total, runoff from 106 off-site acres will be routed to the structural biofiltration BMPs within the development. One area too large to commingle into a biofiltration basin is being treated through a baffle box that will collect trash, debris, and sediment from existing upstream neighborhoods. The developer has also agreed to incorporate a nutrient-sensitive design for the biofiltration BMPs, including a reduced-compost media composition (10% compost) to guard against nutrient export. In addition to the land use change, this treatment is estimated to reduce nutrient loading in the Upper San Marcos HA by 37 kg/year, especially when compared to the historically active golf course. This calculation assumes the same loading estimates for golf courses and residential areas, described in the RI/FS, applied to the same proposed land use acreage to be treated by this project for those land uses.

Construction of the Canopy Grove project continued in FY23. Grading is complete, and nearly all 380 homes and the commercial village center are complete. In Villages 1 and 3, the nutrient-sensitive storm water treatment basins were completed, and the remaining basins have been excavated and are waiting for the media to be placed. Offsite work continued, including a new signal light being installed at Nutmeg Street and County Club Lane.

[4] https://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T10000003261.

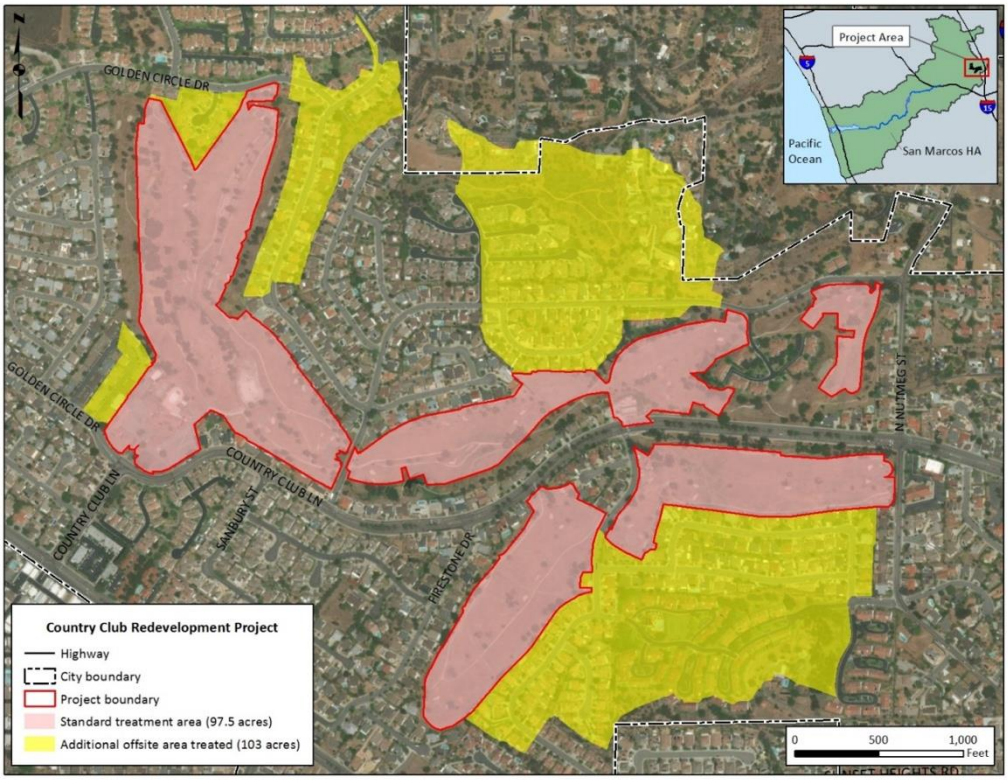

Figure 21: Country Club Redevelopment Project Treatment Areas

Implement Structural or Retrofit BMPs

San Marino Water Quality Improvement Project.

San Marino Drive is located upstream of one of the County's highest priority persistently flowing outfalls, MS4-CAR-072, in the community of Lake San Marcos. The project will treat runoff from approximately 27 acres with a full trash capture device and will treat the runoff from approximately 4.5 acres of adjacent surface streets with biofiltration basins. The goal of the project is the reduction of nutrients, sediment, debris, bacteria, and trash found in the County storm drain system. Construction of the project will begin in FY24 and is expected to be completed in FY24.

Figure 22. San Marino Drive Green Streets and Trash Capture Project Area

3.4 Escondido Creek Hydrologic Area

Riparian habitat degradation is the HPWQC for the Escondido Creek HA (Figure 23). The interim and final goals, progress toward those goals, and strategy highlights are presented in the following sub-sections.

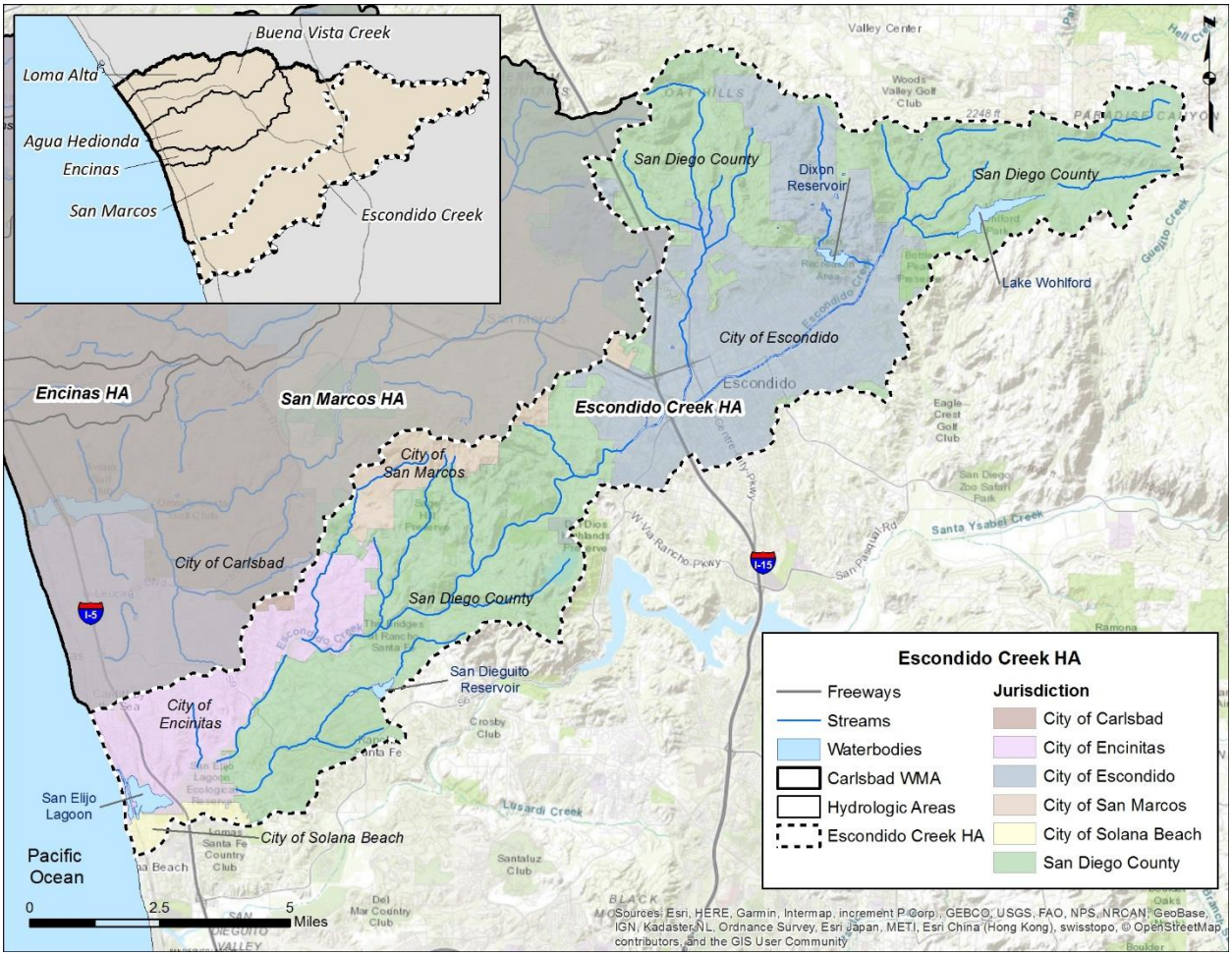

Figure 23: Escondido Creek Hydrologic Area

3.4.1 Goal Progress

In the Escondido Creek HA, the Spruce Street Channel Rehabilitation Project (Spruce Street Project) is identified as a goal to address riparian habitat degradation. Monitoring of goal progress is based on the advancement of project implementation, as presented in Table 10.

Table 10: Escondido Creek HA Progress toward Interim and Final Numeric Goals

Goals		Baseline	Reporting Period Information	Goal Achieved or In Progress?
Wet and Dry Weather (City of Escondido)				
2023 Interim Goal (2018-2023)	*Prioritize the implementation of trash policy measures, as needed per State requirements, in drainage area ESC_134 (737 acres) to benefit Spruce Street Project OR*	*0 trash capture devices installed*	*As reported in the FY18 and FY19 Annual Reports, the City of Escondido installed trash capture devices at approximately 32 storm drain inlets upstream of the Spruce Street Project. The devices have been functioning properly and maintained by the Public Works Department. This effort achieved the 2023 interim numeric goal of prioritizing the implementation of trash policy measures.*	***Achieved***
	Complete 130 feet of the construction for Spruce Street Project (Phase 1 - Valley Parkway overpass, 9% of total project length) OR	0 feet of construction for Spruce Street Project	*Construction for all sections of the Spruce Street Project was initiated in July 2019. Removal of invasive species and accumulated sediment occurred in FY20. Major grading and construction work was completed in FY21. Plant installation was substantially completed in FY22. Plant establishment, vegetation maintenance, and erosion control measures continued through FY23. Final agency sign-off for project revegetation is expected in FY24, at which time the project will be deemed completed.*	**Achieved**
	Removal of invasive species and accumulated sediment from a 250 foot long portion of the Spruce Street Project area	0 feet of project area improved		**Achieved**
2028 Interim Goal (2023-2028)	50% of Spruce Street Rehabilitation Project complete	0%		**Achieved**
2030 Final Goal (2028-2030)	Rehabilitation of 1400 linear feet of open channel and drainage infrastructure as part of the Spruce Street Project	0 linear feet		Achieved

Shaded italicized text denotes the selected compliance method to demonstrate progress for the interim goals

3.4.2 Numeric Goal Strategy Highlights

Strategy highlights in this section present the efforts to establish and improve riparian habitat/native vegetation in the Escondido Creek HA. Riparian/native vegetation are essential components of healthy watersheds that provide critical habitat for wildlife, work as buffers to filter pollutants such as nutrients and sediment, reduce creek bank erosion, and maintain stable creek channel geomorphology. For additional strategies implemented in the HA during the reporting period, refer to Appendix D.

City of Escondido: Spruce Street Channel Rehabilitation Project (Spruce Street Project)

The City of Escondido has made steady progress toward Escondido Creek HA interim and final goals. During FY22, construction work and plant installation were completed (Figure 24). Plant establishment, vegetation maintenance, and erosion control measures continued through FY23. Final agency sign-off for project revegetation is expected in FY24, at which time the project will be deemed completed.

Figure 24: Spruce Street Channel Rehabilitation Project (2021)

3.4.2.1 High Priority Water Quality Condition Strategy Highlights

Reidy Creek Enhancement

The City of Escondido continued efforts to improve riparian habitat in the lowest earthen section of Reidy Creek just north of SR-78 before it becomes channelized and joins with Escondido Creek. The city supported the Escondido Creek Conservancy in implementing a $380,873 California Department of Fish and Wildlife Proposition 1 grant to remove over 600 non-native trees, including Mexican Fan Palms. The grant was awarded in early 2019 and the grant activities were completed in February 2022. The project included developing a long-term management plan as part of the city's Landscape Maintenance District program and the installation of trash capture devices upstream of the project area. In April 2023, City staff partnered with the Escondido Police Department and I Love a Clean San Diego to host Coastal Cleanup Day. Nearly 40 volunteers came together to clean up Reidy Creek.

Figure 25: Interpretive Signage at San Elijo Lagoon

San Elijo Lagoon Restoration

The San Elijo Lagoon is a valuable resource within the Escondido Creek HA, and efforts for the lagoon restoration project are underway. The $120 million restoration project broke ground in November 2017 and is part of the Build North Coast Corridor program of the San Diego Association of Governments and Caltrans. The San Elijo Lagoon Restoration Project (SELRP) includes:

- Vegetation clearing and building a series of dikes along the main lagoon channel and inlet to control water elevations and turbidity,
- Dredging various channels within the lagoon to increase tidal flow,
- Restoring mudflats,

- Establishment of new wetland habitat, and,
- Creation of new pedestrian trails.

In August 2022, the Nature Collective released the *2021 Wetland Habitat and Hydrology Annual Monitoring Report for the San Elijo Lagoon Restoration Project* (AECOM, 2022). The Report summarized the status of the SELRP post-construction for 2020 and 2021, Year 0 and Year 1, respectively. For Year 1, the performance standards for topography, bathymetry, tidal elevations, habitat areas, vegetation cover, exotics cover, wetland function, eelgrass, and *Caulerpa* were met. The report also noted that performance standards for water quality, benthic invertebrates, and fish could not be fully evaluated as additional years of data are needed to calculate the 4-year running averages. To date, no further monitoring reports have been published.

As managing partners of San Elijo Lagoon Ecological Reserve, the County of San Diego Department of Parks and Recreation, Nature Collective, and CDFW will continue to protect sensitive natural resources.

3.5 Buena Vista Creek and Encinas Hydrologic Areas

Currently, no HPWQCs are identified in the Buena Vista Creek and Encinitas HAs (Figure 26 and Figure 27, respectively). Without HPWQCs, no interim and final goals for the HAs are established. However, the Buena Vista Creek and Encinitas HA RAs implemented strategies in the HAs to protect or improve water quality. Appendix D lists and summarizes efforts in the Encinitas and Buena Vista Creek HAs.

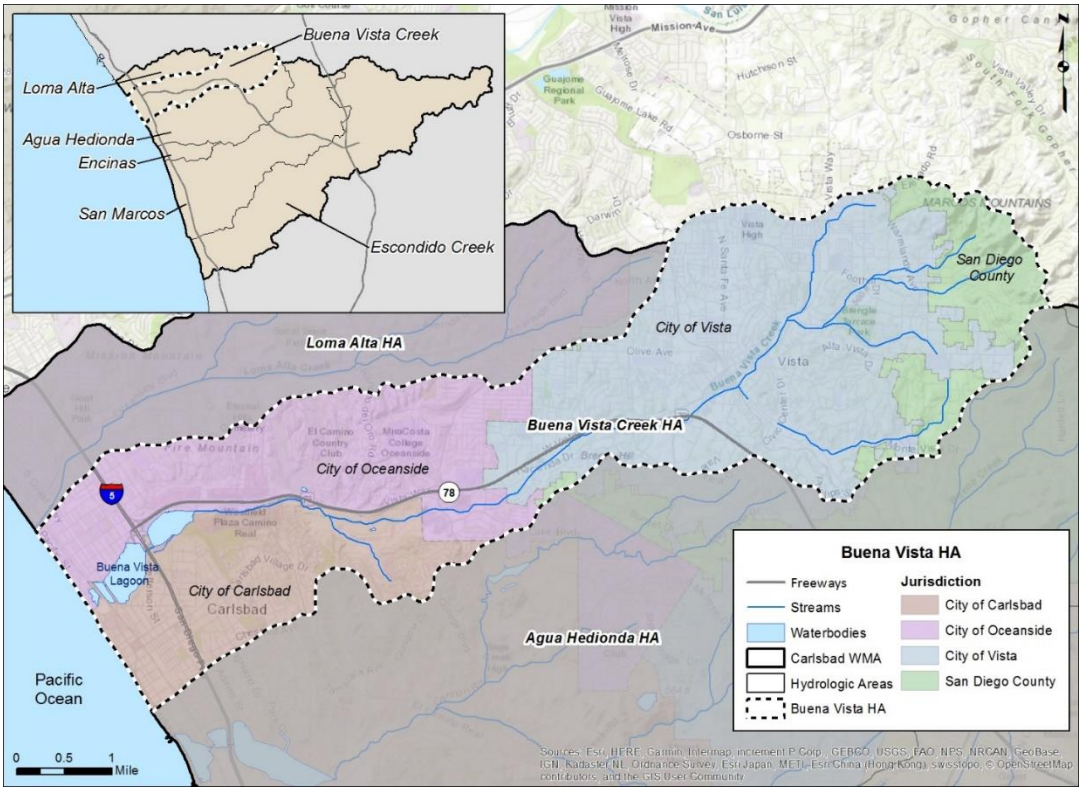

Figure 26: Buena Vista Creek Hydrologic Area

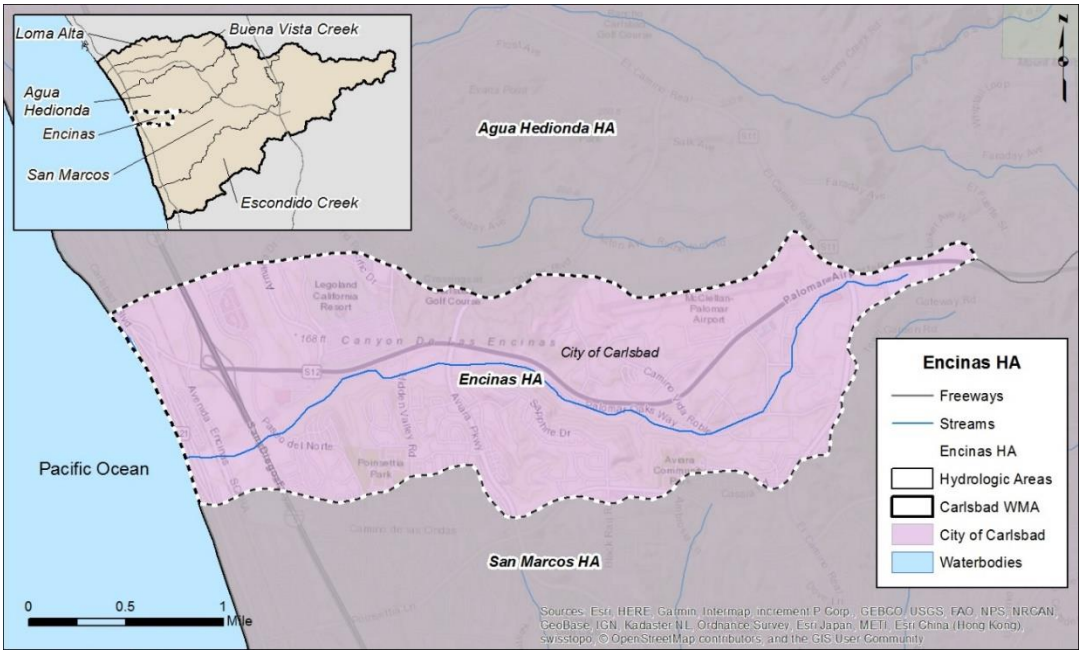

Figure 27: Encinitas Hydrologic Area

4 Water Quality Monitoring and Assessment Program

The WQIP outlines the four major elements of the Water Quality Monitoring and Assessment Program:

1. Monitoring to assess progress toward goals and schedules,
2. Receiving water monitoring program that measures the long-term health of the WMA during dry and wet weather conditions,
3. MS4 outfall monitoring program to investigate and eliminate unauthorized dry weather flows from MS4 outfalls and the improvement in quality of the discharges from storm drains during wet weather, and
4. Special studies that address data gaps or provide information to more effectively address pollutants or stressors that cause or contribute to an HPWQC.

Wet Weather is defined as a storm event of >0.1 inch of rainfall and the following 72 hours after the end of rainfall.

Dry Weather is defined as all days where the preceding 72 hours have been without measurable precipitation (>0.1 inch).

Monitoring information used to assess progress toward goals and schedules is included in each applicable Goal section of this annual report (Section 3). Tables 11 through 13 provide a list of WQIP monitoring programs and identify where information for those programs is located. This Annual Report includes monitoring information collected during the 2022-2023 monitoring year and the respective assessments required by the MS4 Permit. The 2022-2023 monitoring data is submitted to CEDEN, provided on the Project Clean Water website (Regional Clearinghouse), and included in individual attachments to this report.

Various Watershed Monitoring Locations

Table 11: Receiving Water Monitoring Program

WQIP Monitoring Program		Condition	Monitoring Element	Schedule	Data and Information Location
Long-Term Receiving Water Monitoring		Dry	Conventionals, bacteria[1], nutrients[1], metals, pesticides, toxicity (chronic), possible Toxicity Identification Evaluation/ Toxicity Reduction Evaluation, visual observations, field measurements	Once per Permit Term[2]	Regional Monitoring and Assessment Report (RMAR) 2017
			Hydromodification (channel conditions, discharge points, habitat integrity, evidence and estimate of erosion and habitat impacts)		
			Bioassessment (BMI taxonomy, algae[1], taxonomy, physical habitat characteristics)		
		Wet	Conventionals, bacteria[1], nutrients[1], metals, pesticides, toxicity (chronic), field measurements		
Regional Monitoring Participation	Bight	Dry	Chemistry, toxicity, benthic infauna	Once every 5 years[3]	Bight ’13 is included in RMAR 2017. Bight ’18 information and continued monitoring efforts are presented in Section 4.1.1 of this annual report. Bight ’23 sampling efforts will be performed during the next reporting period. Results of Bight ’23 are not expected until FY24.
	SMC	Dry	Bioassessment	Annually	Pre-2016 included in RMAR 2017; 2022-2023 information contained in Section 4.1.2 and Attachment 4 of this annual report.
	2011 Hydromodification Monitoring Program	Wet	Channel assessments, flow monitoring, sediment transport monitoring	Completed	RMAR 2017
Sediment Quality Monitoring	Sediment Quality Monitoring	Dry	Chemistry, toxicity, benthic infauna	Once every 5 years[3] plus continued monitoring[4]	Sediment monitoring was part of Bight ’13 monitoring efforts included in RMAR 2017. Bight ’18 information and continued monitoring efforts are presented in Section 4.1.1 of this annual report. Bight ’23 sampling effort will be performed during the next reporting period. Results of Bight ’23 are not expected until FY24.
Long-Term Water Quality Monitoring at Loma Alta Slough	Macroalgae growth and nutrient loading	Dry	Nutrients[1], dissolved oxygen, conductivity, pH, temperature, turbidity, flow, macroalgae cover, and biomass	Annually through 2022	Section 3.1 and Attachment 1 of this annual report.
Long-Term Flow & Water Quality Monitoring at Upper San Marcos Creek	Year-round flow monitoring & wet weather nutrient loading	Wet/Dry	Nutrients [1], total suspended solids, and flow	Annually	Section 3.3.2 and Attachment 2 of this annual report.
TMDL Monitoring	Bacteria TMDL for Moonlight Beach	Dry	Bacteria[1]	Annually[5]	Pre-2016 included in RMAR 2017; 2022-2023 data and information included in Section 3.3.1 and Attachment 7 of this annual report.
		Wet	Bacteria[1]		

BMI=Benthic macroinvertebrates
Bacteria = fecal indicator
SMC=Southern California Storm Water Monitoring Coalition
Bight=Southern California Bight Regional Monitoring Program
[1]Bacteria and nutrient-related analytical testing are related to the Highest Priority Water Quality Conditions in the Carlsbad WMA.
[2]Completed under the Transitional Monitoring Program in accordance with Permit Provisions D.1.a and D.2.a.
[3]The 2023 Southern California Bight Regional Monitoring occurred during the summer of 2023.
[4]Continued sediment monitoring occurs at sites identified as ‘Possibly Impacted.’ These sites include the Agua Hedionda Lagoon and Batiquitos Lagoon.
[5]Pre-2016, the County of San Diego Department of Environmental Health & Quality conducts dry weather monitoring at beaches, including Moonlight Beach, under the Assembly Bill 411 (AB411) Monitoring Program.

Table 12: MS4 Outfall Monitoring

WQIP Monitoring Program	Condition	Monitoring Element	Permit Schedule	Data and Information Location
MS4 Outfall Field Screening	Dry	Visual: flow condition, assessment of trash in and around the station, IC/IDs	Annually[2]	2022-2023 information is included in Section 4.3 and Attachment 3 of this annual report.
MS4 Outfall Monitoring	Dry	Field parameters, conventionals, bacteria[1], nutrients[1], metals, pesticides		2022-2023 information is included in Section 4.3 and Attachment 3 of this annual report.
	Wet	Field parameters, conventionals, bacteria[1], nutrients[1], metals, pesticides		

IC/ID = illicit connection and/or illicit discharge
bacteria = fecal indicator
[1]Bacteria and nutrient-related analytical testing are related to the Highest Priority Water Quality Conditions in the Carlsbad WMA.
[2]2013-2014 and 2014-2015 efforts completed under the Transitional Monitoring Program per MS4 Permit Provisions D.1.a and D.2.a.

Table 13: Carlsbad WMA Special Studies and Additional Investigations Monitoring

WQIP Monitoring Program	Condition	Monitoring Element	Schedule	Data and Information Location
San Diego Regional Reference Streams and Beaches Study[2]	Dry	Field parameters, conventionals, bacteria[1] instantaneous flow	2013-2014; 2014-2015[2]; 2015-2016	Study complete and included in RMAR Appendix of 2017 ROWD.
		Streams only: nutrients[1], metals, algae bioassessment[1], including physical habitat and chlorophyll a[1]	2013-2014	
	Wet	Field parameters, conventionals, bacteria[1]	2013-2014; 2014-2015; 2015-2016	
		Streams only: nutrients[1], metals, toxicity, flow, and precipitation (storm duration)	2013-2014; 2014-2015	
Bight '13 Microbiology Drainage Water Study	Wet, Dry	Bacteria[1], Microbial Source Tracking[1]	2013-2014	Study complete and included in FY17 Carlsbad WQIP Annual Report.
Clean Beaches Initiative Grant – Microbial Source Identification Study for Buccaneer Beach and Loma Alta Creek	Wet, Dry	Field parameters, cultivable Fecal Indicator Bacteria and human-associated, dog-associated, and avian-associated microbial source tracking genetic marker assays	2016-2017; 2017-2018	Study complete and included in FY17 Carlsbad WQIP Annual Report.
Dry Weather Special Studies at Identified Major Persistent Flow Outfalls	Dry	Bacteria, nutrient[1] and/or flow monitoring	2015-2016 to 2018-2019	Numerous studies were completed across multiple HAs. See Table 21 for specifics.
Dry Weather MS4 Outfall Flow Source Investigations	Dry	Flow monitoring	2018-2019; 2019-2020; 2021-2022, 2022-2023	Numerous studies were completed across multiple HAs. See Table 21 for specifics.
Agua Hedionda Lagoon Phased Approach Addressing Indicator Bacteria	Dry	Bacteria	2021-2022	Phase I Study complete and included in FY22 Carlsbad WQIP Annual Report as Attachment 11
McClellan-Palomar Airport Water Quality Treatment Facility and Long-Term Effectiveness Monitoring (County of San Diego)	Wet	Field parameters, flow, nutrients, metals	2006-2007 through 2012-2013, 2016-2017, 2018-2019, 2019-2021, 2021-2022, 2022-2023	Study complete and included in FY19 Carlsbad WQIP Annual Report. Additional verification monitoring was performed and the monitoring report is included in Attachment 9.

[1]Bacteria, nutrient, algae bioassessments, physical habitat, or biomass related analytical testing is related to Highest Priority Water Quality Conditions in the Carlsbad WMA.
[2]The Reference Beaches Study dry weather monitoring program was implemented during 2014-2015. The Reference Streams Study dry weather monitoring was completed in 2013-2014.

4.1 Receiving Water Monitoring

The sections below summarize the receiving water monitoring conducted during the reporting period. Long-term receiving water monitoring is required once per permit term and was completed in the 2014-2015 monitoring and assessment program period. The next receiving water monitoring is anticipated after the MS4 Permit is reissued and adopted. Receiving water monitoring related to WQIP goals is presented in the applicable HA sub-sections in Section 3 of this report.

4.1.1 Southern California Bight Regional Monitoring Program

The Southern California Bight 2023 Regional Monitoring Program (Bight '23) completed its sampling efforts during the summer and early fall of 2023. The results of the monitoring are expected to be included in the FY24 WQIP annual report.

The Bight '18 was the 7th iteration of a multi-agency (including Carlsbad WMA RAs) collaborative effort led by the Southern California Coastal Water Research Project (SCCWRP). Bight program participants develop, plan, and implement a monitoring program to answer specific questions during each five-year program cycle. Planning documents for Bight '18 were completed in 2018. Five final assessment reports are available on the SCCWRP website, and the remaining reports will be available online as they are completed.

The following sections present findings from the Sediment Quality sampling efforts in 2018, confirmation monitoring efforts in 2019, and source identification efforts from this reporting period.

4.1.1.1 Sediment Quality Sampling

Sediment quality (chemistry, toxicity, and benthic infauna) sampling in the Carlsbad WMA was performed at six locations (three locations in both Agua Hedionda Lagoon and Batiquitos Lagoon) on September 11 and 12, 2018 (Table 14 and Figure 28). Final sediment quality objective (SQO) station level assessments for each station in the two lagoons and individual lines of evidence are provided in Table 15.

Table 14: Bight '18 Sampling Locations within the Carlsbad WMA

Waterbody	Station Identification	Target Latitude	Target Longitude	Bight '18 Stratum
Agua Hedionda Lagoon	B18-10168	33.140126	-117.324378	Estuary
	B18-10169	33.139452	-117.31874	Estuary
	B18-10170	33.139112	-117.337572	Estuary
Batiquitos Lagoon	B18-10171	33.08985657	-117.2786859	Estuary
	B18-10172	33.08963637	-117.2947619	Estuary
	B18-10173	33.089536	-117.284912	Estuary

Table 15: Bight '18 Lines of Evidence and Final SQO Assessments

Waterbody	Station Identification	Sediment Chemistry Exposure	Benthic Community Condition Impact	Sediment Toxicity	Final Station Assessment
Agua Hedionda Lagoon	B18-10168	Low	High	Moderate	Likely impacted
	B18-10169	Low	Moderate	Low	Possibly impacted
	B18-10170	Low	Reference	Nontoxic	Unimpacted
Batiquitos Lagoon	B18-10171	Low	High	Moderate	Likely impacted
	B18-10172	Minimal	Moderate	Nontoxic	Likely unimpacted
	B18-10173	Low	Moderate	Moderate	Possibly impacted

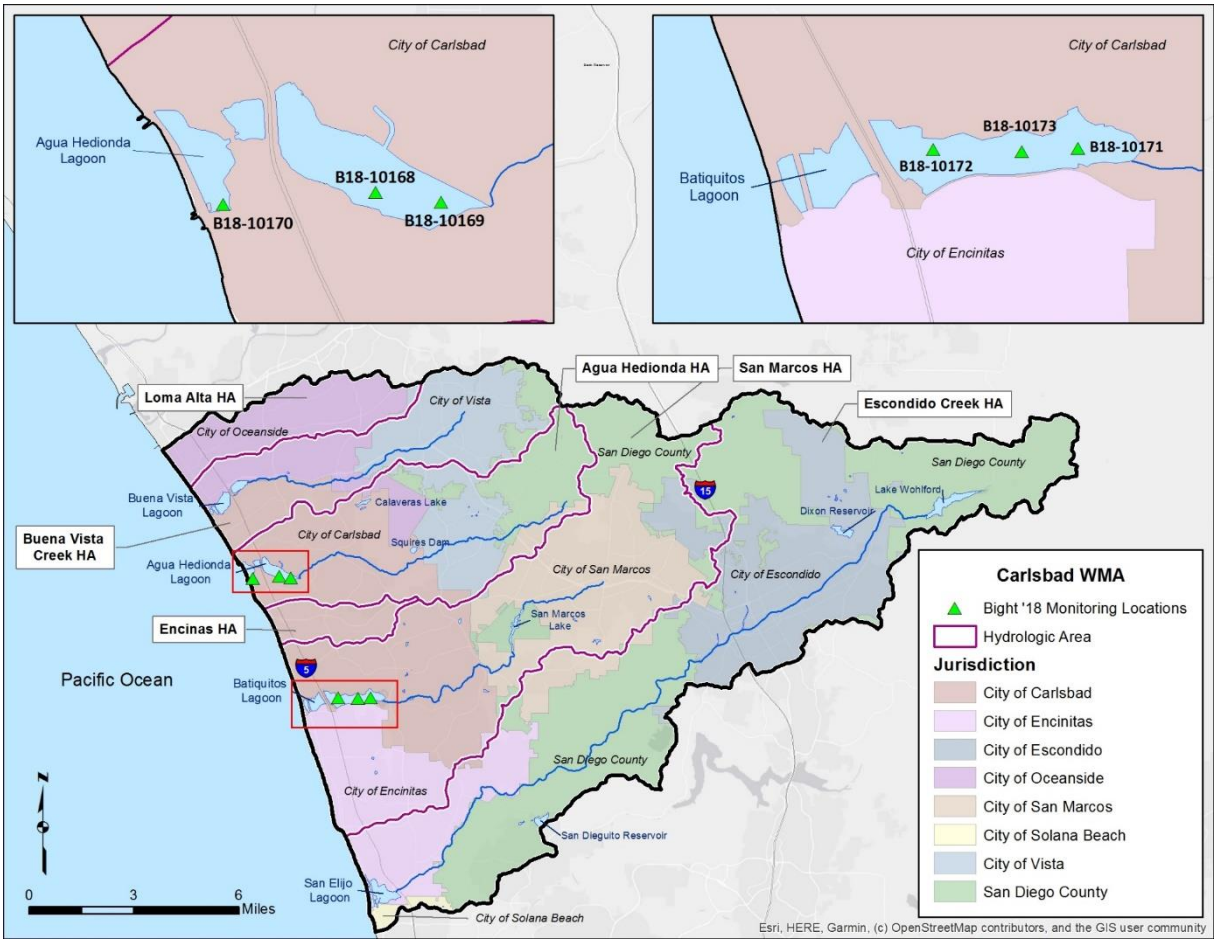

Figure 28: Carlsbad WMA Bight '18 Monitoring Locations

4.1.1.2 Confirmation Monitoring

In September 2019, the RAs initiated an investigation to confirm and characterize the Possibly Impacted station in each lagoon and collected additional information at the Likely Impacted stations identified through the sediment monitoring efforts in 2018. Confirmation monitoring was performed per the Sediment Quality Objectives Confirmation Monitoring Work Plan (Weston Solutions, 2019), and results are presented in Table 16.

Table 16: Confirmation Monitoring Mean SQO Results (September 2019)

Waterbody	Station Identification	Sediment Chemistry Exposure	Benthic Community Condition Impact	Sediment Toxicity	Final Station Assessment
Agua Hedionda Lagoon	AH168	Low	Moderate	Low	Possibly Impacted
	AH169	Minimal	Moderate	Non-toxic	Likely Unimpacted
Batiquitos Lagoon	BT171	Low	Moderate	Low	Possibly Impacted
	BT173	Minimal	Low	Non-toxic	Unimpacted

4.1.1.3 Sediment Stressor Identification

After confirmation monitoring, the RAs prepared and submitted a Stressor Identification Work Plan (Weston, 2021) to the RWQCB to identify and understand sources of water quality impacts. The RWQCB approved this work plan in May 2021, and field sampling was performed in FY22. The Sediment Stressor Identification Study Report (FY22 Carlsbad WQIP Annual Report - Attachment 8) presents the September 2019 Confirmation Monitoring efforts and provides a detailed analysis and discussion of stressor identification results.

Toxicity Identification Evaluations (TIEs), chemistry and biological analyses, and historical data from previous surveys within Agua Hedionda Lagoon and Batiquitos Lagoon were used for the Sediment Stressor Identification Monitoring study. This information was used to identify if the monitoring stations' stressors were related to toxic pollutants in the sediments or disturbances to the water column. The study included three sites: two sites in Agua Hedionda Lagoon (B18-10168 and B18-10169 and one in Batiquitos Lagoon (B18-10171).

For one site in Agua Hedionda Lagoon (B18-10168) and the site in Batiquitos Lagoon (B18-10171), TIE efforts were initiated to determine the cause of toxicity. There were no causal sources of toxicity identified, and ultimately a determination of the cause of toxicity in sediments was not found for either site.

Low chemistry and toxicity scores suggest that chemical exposure at Agua Hedionda Lagoon site B18-10169 was not a source of biological disturbance, therefore, a TIE was not performed at the site. Based on the benthic community stressor evaluation, the benthic community was typical of a southern California shallow-water lagoon and did not appear to be negatively impacted by chemically mediated effects.

Agua Hedionda Lagoon is highly dynamic and influenced by multiple conditions such as tides, currents, eddies, recreational activities, groundwater exchange, and freshwater input. While not quantified, anthropogenic physical disturbance (e.g., boat wash, paddle disruption, boat groundings, tramping via paddlers wading, etc.) may be a potential cause of the sediment results.

In FY23 the RAs continued to coordinate with RWQCB staff regarding data and potential next actions. RAs stated their intent is to move forward with participating in the Bight '23 program and collect and analyze samples at the sites in question. Based on the results, RAs will coordinate with RWQCB staff on next actions, if any.

4.1.2 Storm Water Monitoring Coalition Regional Bioassessment Program

The Southern California Storm Water Monitoring Coalition (SMC) began an approach to evaluate the biological condition of California's wadeable streams in southern California's coastal watersheds in 2009. The RAs have participated in the monitoring effort since the program's inception. The first five years (2009-2013) of this program established a baseline for monitoring trends. In 2021, the third iteration of the 5-year SMC Work Plan was initiated to build off the initial surveys (SCCWRP 2021).

2021-2025 Storm Water Monitoring Coalition (SMC) Bioassessment Program

"Trend" sites are sampled either once during the five-year work plan (i.e., 'Panel 1' Trend sites) or sampled 3 to 4 times during this monitoring cycle (i.e., 'Panel 2' Trend sites).

"Condition" sites are randomly selected and do not remain consistent from year to year.

In accordance with the SMC Workplan, the monitoring conducted during the 2022-2023 monitoring year incorporated the following components:

- Benthic macroinvertebrate (BMI) sample collection and identification
- Diatom sample collection and identification, soft bodied algae collection for archive
- Water quality chemistry sample collection and analysis
- Physical habitat (PHAB) assessment
- Physical riparian habitat assessment (California Rapid Assessment Method (CRAM)

During the 2022-2023 monitoring year, monitoring was conducted at two sites. The first was condition site 904M21800, which is situated on Loma Alta Creek in the City of Oceanside. This site was visited on June 28, 2023. The second site was panel 2 trend site SMC00537, a natural bottom channel in the Escondido Creek HA. This site was visited on June 27, 2023. Bioassessment metrics are summarized in Table 17, and results are presented in Table 18.

Table 17: Bioassessment Metrics

Metric	Description
California Stream Condition Index (CSCI) or CSCI Condition Category	CSCI translates complex data about individual BMIs living in a stream into an overall measure of stream health. CSCI scores range from 0 to 1 and correspond to CSCI condition categories ranging from 'Likely Intact' (CSCI score 0.92 or greater) to 'Very Likely Altered' (CSCI score of 0.62 or less).
California Rapid Assessment Method (CRAM)	CRAM assesses the condition of wetlands and riparian habitats. The CRAM score describes the capacity of the assessed habitat to perform functions relative to a reference condition. CRAM scores range from 25 to 100, where a high score indicates a high capacity for habitat to perform beneficial habitat functions.
Algal Stream Condition Index (ASCI)	ASCI assesses benthic algae in freshwater algal communities and is a refinement of previous regional algal IBI scoring tools. The ASCI has a scoring range of 0-1.0, with scores relative to the statewide pool of non-disturbed reference sites. The ASCI diatom index is broken into the following algal community conditions classes: likely intact >0.94), possibly altered (<0.94 to 0.86), likely altered (<0.86 to 0.75), and very likely altered (<0.75).

Table 18: SMC Regional Bioassessment Program Reporting Period BMI and Algae Results Summary

Site	Metric	Result
Condition Site 904M21800	CSCI Condition Category	Likely Altered (CSCI score 0.71)
	Overall CRAM Score	58[1]
	ASCI Condition Class	Very Likely Altered (ASCI score 0.72)
Trend Site SMC00537	CSCI Condition Category	Very Likely altered (CSCI score 0.42)[2]
	Overall CRAM Score	76[1]
	ASCI Condition Class	Very Likely Altered (ASCI score 0.53)[3]

[1] CRAM score of 76 and 78 indicates a high capacity to perform beneficial habitat functions.
[2] Duplicate sample scored 0.47, Very Likely Altered condition class.
[3] Duplicate sample scored 0.44, Very Likely Altered

Figure 29: SMC Condition Site 904M21800 Loma Alta Creek, in City of Oceanside (Weston Solutions)

The Loma Alta Creek condition site, 904M21800, (see Figure 29) has biological community scores indicating that the BMI community is likely altered (CSCI score of 0.71), while the diatom community appears degraded (ASCI score of 0.72, Very Likely Altered). Several studies have demonstrated that the BMI community responds strongly to physical habitat and hydrologic-regime related stressors, whereas the algal community responds to nutrient and water chemistry-related stressors (Theroux, 2020, Mazor, 2015). A CRAM score of 58 indicates that some measures of physical habitat at 904M21800 are of moderate quality. The lowest scoring CRAM attribute sub-score was related to limited habitat buffer due to the site proximity to urban development. SWAMP physical habitat assessment measures indicate the stream is limited in flow habitat diversity, composed primarily of glides and pool habitat with few riffles. While all of the of water quality analytes were below their respective benchmarks specific conductivity, chloride, total hardness, and sodium values were relatively high. Station 904M21800 scored poorly for three of the six diatom ASCI sub metrics indicating an abundance of diatom taxa tolerant to disturbance, taxa tolerant of eutrophic conditions, and taxa tolerant to increased salinity environments.

Figure 30: SMC Trend Site SMC00537 Escondido Creek near Olivenhain

The biological community index scores at site SMC00537 indicate that both the BMI and diatom algal communities are Very Likely Altered (CSCI score of 0.42, ASCI score of 0.53). The physical habitat at SMC00537 is of relatively high quality as indicated by the CRAM score of 76, however the stream bed is of low gradient and riparian buffer community is of limited width and habitat quality. Specific conductivity, chloride, sulfate, and total nitrogen values at SMC00537 were elevated (Table 3-4). Specific conductivity is a measurement of the ability of water to conduct electricity where dissolved ions (i.e., Na+, Ca+2, SO4-2, etc.) serve as the conductor (Clean Water Team [CWT] Fact Sheet-3.1.3.0(EC)V2e, 2004). As such, specific conductance is related to TDS content. Although the effect of elevated TDS on BMI is variable among different taxa and not well understood, a number of studies have demonstrated a correlation between changes in conductivity/TDS and both altered BMI (Minshall and Minshall, 1978) and algal communities (Leland and Porter, 2000). Results from the first SMC five-year report suggested that elevated TDS is a condition common to the entire region, affecting 76% of stream miles in southern California (Mazor, 2015). Station SMC00537 scored poorly for five of the six diatom ASCI sub metrics indicating an abundance of diatom taxa tolerant to disturbance, taxa tolerant of eutrophic conditions, and taxa tolerant to increased salinity environments.

Refer to Attachment 4 for results and details on the 2022-2023 Stream Bioassessment Monitoring.

4.1.3 Agua Hedionda Lagoon

The following efforts were performed during the reporting period as part of the *Agua Hedionda Phased Approach Addressing Indicator Bacteria* to protect SHELL and REC-1 Beneficial Uses in Agua Hedionda Lagoon – see Appendix D for details.

4.1.3.1 SHELL Beneficial Use

Phase I of the Agua Hedionda SHELL approach aims to assess whether water quality in Agua Hedionda Lagoon supports commercial shellfish harvesting under open conditions[5]. Attainment of the Phase I objective is supported by the continued implementation of strategies to improve water quality in the Lagoon and a monitoring and assessment component focused on evaluating available monitoring data within the shellfish growing area.

FY23 strategies implemented by RAs include:

- Bacteria reduction strategies (e.g., property-based inspections, outreach to homeowners' associations, irrigation runoff reduction)
- Human source reduction strategies (e.g., strategies to address homelessness, Sanitary Sewer Management Plans (SSMPs), Onsite Wastewater Treatment System (OWTS) investigations)

[5] Beneficial uses for commercial shellfish harvesting are monitored and managed by the California Department of Public Health (CDPH). Open condition refers to the time period in which shellfish harvesting is allowed by CDPH. CDPH practice throughout the State is to suspend harvesting operations following rain events. In Agua Hedionda Lagoon the threshold for "closure" is defined as >0.4" over a 24-hour period with a closure length of 72 hours. In the case of extreme weather events, defined as >1.5" over 24 hours or >3.00" over 7 days, harvesting is closed indefinitely until sample results are below thresholds established by the National Shellfish Sanitation Program (NSSP). All harvested shellfish are also subject to a depuration process to ensure that they are safe for consumption. This is common practice due to the filter feeding nature of shellfish and is not indicative of beneficial use impairment, but rather practical management of shellfish harvesting operations to protect public health.

- The City of Carlsbad and County of San Diego participated in a Bacteria Summit to discuss water safety standards and research needs. Key takeaways include the need for more research, collaboration among agencies, and the interest in a shellfish safety index.

Monitoring data, see Figure 31 and Figure 32, in the shellfish growing area met quality benchmarks, supporting the SHELL beneficial use. Still, efforts are needed to deter birds from roosting among the growing lines, as they contribute to contamination in shellfish tissue.

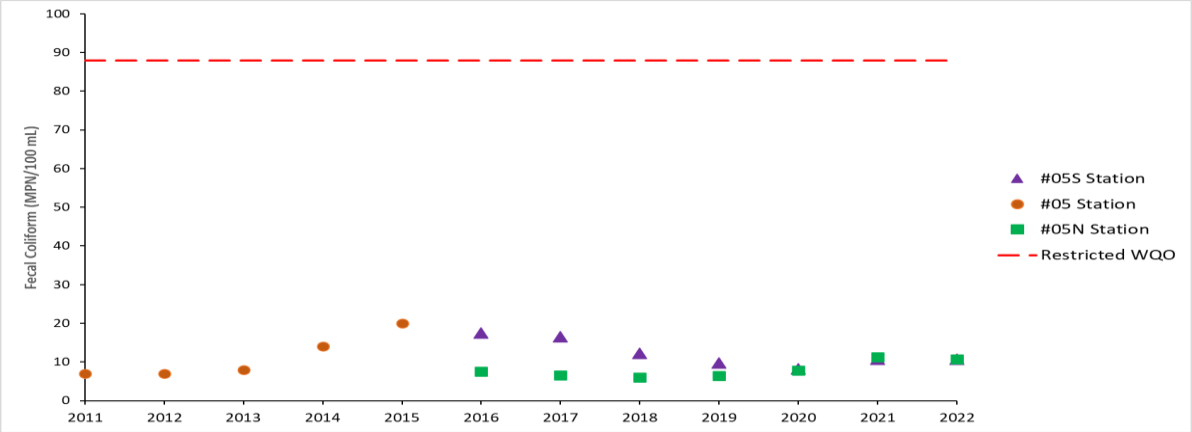

Figure 31. Agua Hedionda Lagoon: Fecal Coliform Data as compared to National Shellfish Sanitation Program Geometric Mean benchmark for Restricted and Conditionally Restricted Shellfish Harvesting, (2011 – 2022), CDPH

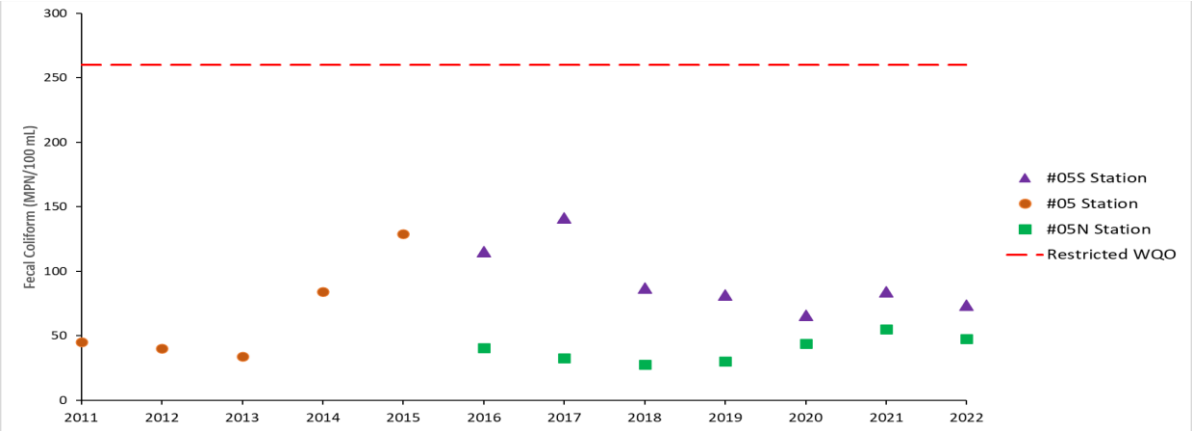

Figure 32. Agua Hedionda Lagoon: Fecal Coliform Data as Compared to National Shellfish Sanitation Program 90th Percentile benchmark for Restricted and Conditionally Restricted Shellfish Harvesting (2011 – 2022), CDPH

4.1.3.2 REC-1 Beneficial Use

The objective of Phase I of the REC-1 Approach was to determine whether water quality conditions continue to support the REC-1 beneficial uses as indicated in previous studies (MACTEC, 2009; State Water Board, 2010). A monitoring and assessment component, completed in September 2022, demonstrated te the REC-1 beneficial use is supported.

As stated above, the RAs continue implementing strategies to improve water quality in the Lagoon, and more effectively communicate potential water quality concerns to the public, including:

- Bacteria reduction strategies (e.g., property-based inspections, outreach to homeowners' associations, irrigation runoff reduction)
- Human source reduction strategies (e.g., strategies to address homelessness, Sanitary Sewer Management Plans (SSMPs), Onsite Wastewater Treatment System (OWTS) investigations)
- Improved the signage posted at public access points to the Lagoon

4.2 Additional Receiving Water Assessment

Heal the Bay, an environmental non-profit organization, develops an annual beach report card designed to provide beachgoers with reliable beach water quality information. The *2022-2023 Annual Beach Report Card* (2023, Heal the Bay) is a summary of the past year's water quality, specifically Fecal Indicator Bacteria (FIB), for three distinct periods:

- Summer dry weather – April 2022 through October 2022
- Winter dry weather – November 2022 through March 2023
- Year-round wet weather conditions[6] – April 2022 through March 2023

The Report Card classifies beaches along the West Coast (Washington, Oregon, and California) on an A through F grading scale. The complete report is included as Attachment 5 and the grading methodology is provided in the report.

Based on the review and analysis of FIB sampling data, no Carlsbad WMA beaches were placed on the Beach Report Card's Honor Roll. In past years, six Carlsbad WMA beaches were consistently Honor Roll beaches. For a beach to make the Honor Roll, the beach had to have been monitored weekly year-round and receive only exceptional (A+) grades during all seasons and weather conditions. Per Beach Report Card, "only two out of over 500 monitored beaches made it on the Honor Roll compared to 51 last year. Unfortunately, the unprecedented amount of rain that fell across California during the 2022–2023 winter led to an enormous dip in water quality and a very short Honor Roll list."

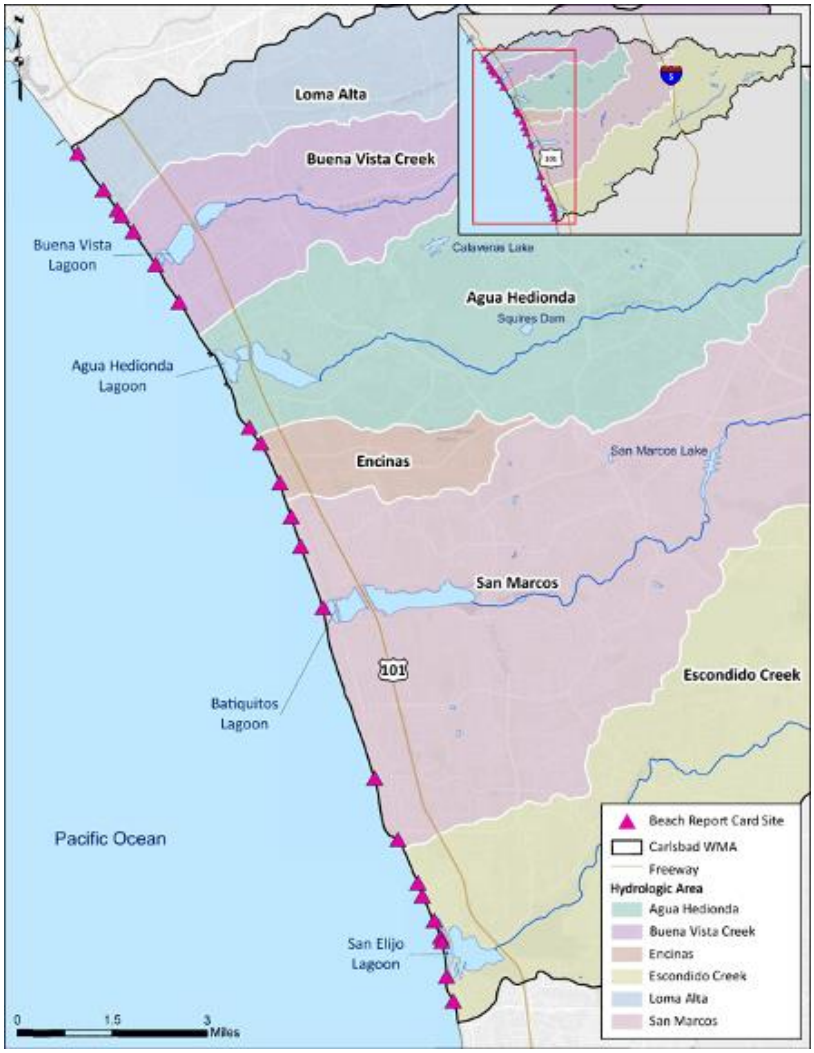

Figure 33: Heal the Bay Carlsbad WMA Sites

22 Carlsbad WMA sites were assigned grades in the Beach Report Card:

- **85%** of the 13 sites monitored during the **summer dry weather** period received an A+ or A grade.
- **75%** of the 4 sites monitored during the **winter dry weather** period received an A+ or A grade.
- **52%** of the 21 sites monitored during the **year-round wet weather** period received an A+, A, or B grade.

[6] Samples taken during or within 72 hours of a rain event. Heal the Bay used a definition of a rain event in California as precipitation greater than or equal to one tenth of an inch (>=0.1").

4.3 MS4 Outfall Monitoring

During the reporting period, the RAs conducted the MS4 Outfall Monitoring Program to monitor the discharges from the priority MS4 outfalls within the Carlsbad WMA during dry and wet weather conditions. The 2022-2023 wet and dry weather monitoring results for the MS4 Outfall Monitoring Program are summarized in the following sections. Detailed information and assessments are provided in Attachment 3.

Storm Water Action Levels (SALs)
The level of a pollutant or constituent during *wet weather* that when exceeded indicates control measures may need to be evaluated and source investigations may need to be prioritized.

4.3.1 Wet Weather MS4 Outfall Monitoring

The Carlsbad WMA RAs performed wet weather MS4 outfall discharge monitoring to characterize pollutants in storm water discharges from the MS4, guide pollutant source identification efforts, and track progress in achieving goals, where applicable. The eight monitored wet weather MS4 outfall locations in the WMA are presented in Table 19. Wet weather MS4 outfall sites remain unchanged for the 2022-2023 monitoring year.

Table 19: 2022-2023 MS4 Outfall Monitoring Locations

Site ID	Jurisdictional Site ID	Responsible Agency	HSA Name/ No.	Latitude	Longitude
MS4-CAR-1	16C-61*	City of Carlsbad	Los Manos / 904.31	33.1460	-117.3380
MS4-CAR-2	CBS-10 (75SWOUTL)	City of Encinitas	San Elijo / 904.61	33.0181	-117.2817
MS4-CAR-3	ESC_108**	City of Escondido	Escondido / 904.62	33.14789	-117.03923
MS4-CAR-4	LA-048*	City of Oceanside	Loma Alta / 904.1	33.2111	-117.2706
MS4-CAR-5	B-02	City of San Marcos	Richland / 904.52	33.146	-117.16024
MS4-CAR-6	North Rios (NRIO)	City of Solana Beach	San Elijo / 904.61	33.0039	-117.2721
MS4-CAR-7	BV-1	City of Vista	El Salto / 904.21	33.1827	-117.2839
MS4-CAR-8	MS4-CAR-007*	County of San Diego	San Elijo / 904.61	33.0329	-117.2352

*Monitoring location added in 2015-2016 monitoring year.
** Monitoring location added in 2020-2021 monitoring year.

The wet weather MS4 outfall monitoring program measured and compared parameters to applicable Storm Water Action Levels (SALs). Parameters with SALs are listed below. *Enterococcus* and *E. Coli* do not have SALs but were measured and compared to the statistical threshold value (STV) per the Bacteria Provisions (State Water Board, 2018) (San Diego Region Basin Plan, September 2021).

- Turbidity
- Total Cadmium
- Total Copper
- Total Lead
- Total Zinc
- Nitrate + Nitrite as N
- Total Phosphorus

Results from the samples collected during wet weather events are compared to SALs to indicate the performance of storm water control measures. If a pollutant/constituent is above the SAL, it may indicate that control measures need to be evaluated or source investigations need to be prioritized. If a constituent is at or below the SAL, then it is not expected to impact receiving water quality, and no further action is necessary.

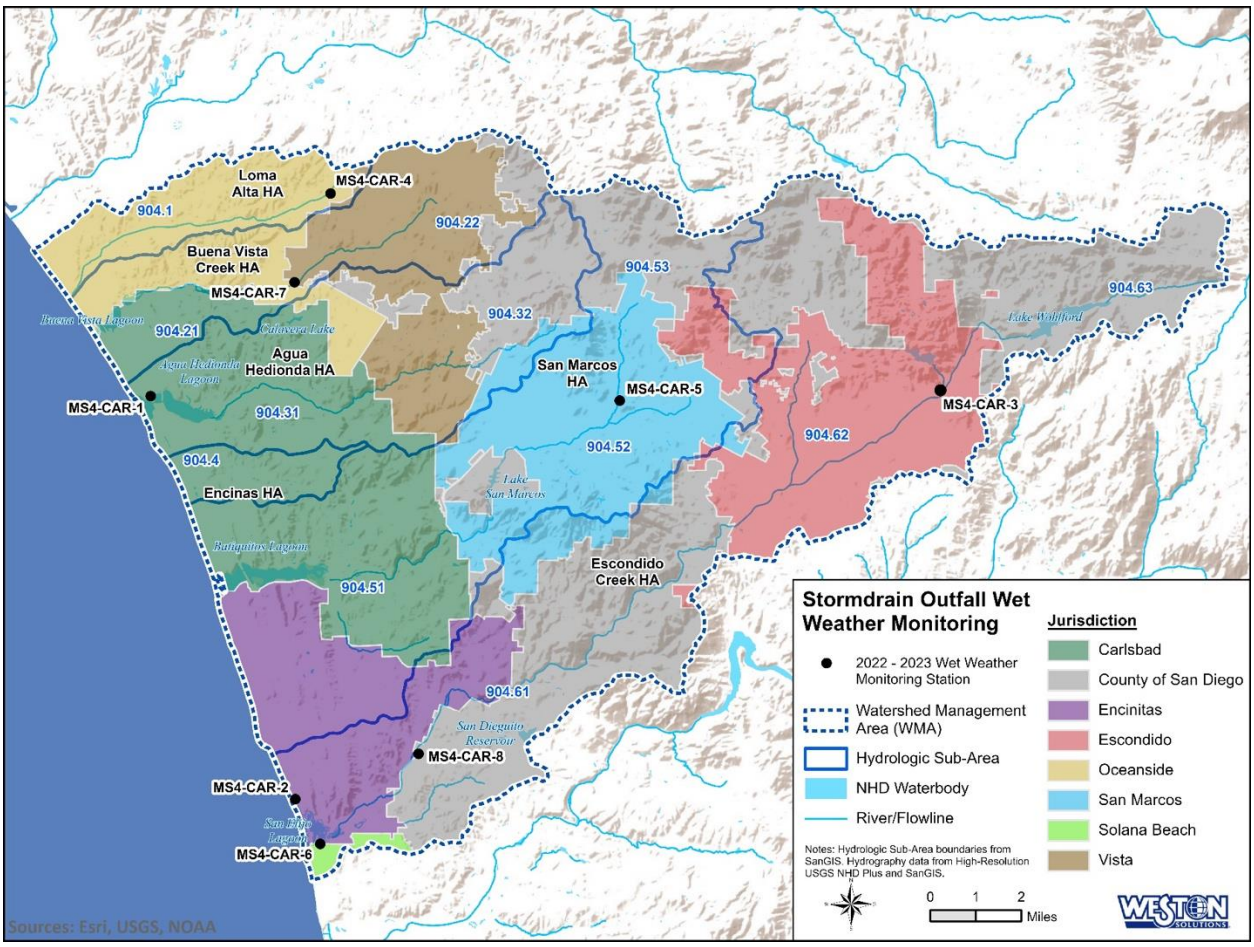

Figure 34: 2022-2023 Wet Weather MS4 Outfall Monitoring Locations

During the 2022-2023 monitoring year, the eight outfalls were monitored once in the wet season across four storm events. The storm events total rainfall amounts ranged from 1.4 inches to 1.65 inches. Results for total cadmium, total copper, total lead, total zinc, and turbidity at all monitored sites were below applicable SALs. One result, Nitrate + Nitrite as N, exceeded the SAL at two outfalls. Fecal indicator bacteria (*Enterococcus* and *E. Coli)* results were above the applicable SAL at all eight wet weather monitoring locations. In all, 52 out of 69 wet weather analytical results (75%) were in compliance with the applicable action levels.

SALs support the development and prioritization of water quality improvement strategies for reducing pollutants in storm water discharges from the MS4s and can assess the effectiveness of strategy implementation. The RAs are implementing strategies targeting the constituents that exceeded SALs and will continue to evaluate progress. Fecal indicator bacteria, the constituent with the most prevalent SAL exceedances, is a PWQC or HPWQC for numerous waterbodies in the watershed, and strategies to address FIB are being implemented.

4.3.2 Dry Weather MS4 Outfall Monitoring

The RAs performed monitoring to identify non-storm water and illicit discharges within their respective jurisdictions. The Dry Weather MS4 Outfall Monitoring Program includes field observations (field screening) and analytical monitoring of prioritized major MS4 outfalls. Efforts conducted during the 2022-2023 monitoring year are summarized below. Further information and data, including load assessments and methodology are included in Attachment 3 of this annual report.

4.3.2.1 Field Screening

During the 2022-2023 monitoring year, the RAs conducted a total of 810[7] major MS4 outfall visual observations. During the observations, the RAs classified each outfall based on the following categories.

- **Persistent** – having flowing, pooled, or ponded water more than 72 hours after a measurable rainfall event of 0.1 inches or greater during the three most recent consecutive monitoring and/or inspection events
- **Transient** – having flowing, pooled, or ponded water during at least one but not on all three most recent consecutive monitoring and/or inspection events conducted more than 72 hours after rainfall with daily precipitation ≥0.1 inch
- **Tidal** – having persistent or transient flow with ocean tides as the source
- **Dry** – having no flowing, pooled, or ponded water during the previous three consecutive monitoring and/or inspection events conducted more than 72 hours after rainfall with daily precipitation ≥0.1 inch
- **Unknown** – site cannot be evaluated or has not been visited enough times to determine flow status

Fifty-one percent of observations (410 of 809) indicated no flow (dry or pooled/ponded conditions). Some flow observations were noted as a trickle, and not all of these flows were measurable. Of the observations where flows could be estimated, 62% (244 observations) had estimated flows less than five gallons per minute (gpm).

Based on the observations, Figure 35 presents the flow determination category for the 483 major MS4 outfalls within the WMA during the 2022-2023 monitoring year.

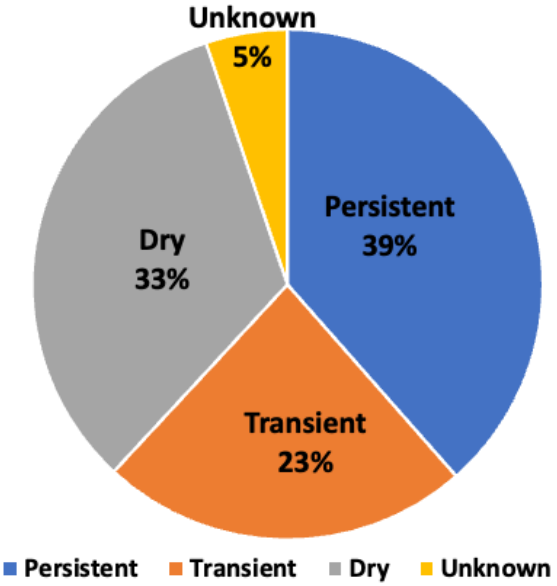

Figure 35: 2022-2023 WMA Major MS4 Outfall Flow Determinations
Dry Weather MS4 Monitoring Program

In addition to classifying outfall flow characteristics, RAs recorded information on whether there was a potential non-storm water flow source and type, whether the flow source was eliminated, and if there was evidence of any illegal connections/illicit discharges (see Attachment 3) RAs investigate the source flow to identify and eliminate non-storm water discharges when applicable. Irrigation runoff was the most commonly known or suspected source of non-storm water flow from persistent or transient outfalls found during the investigations. Other sources included residential washing, water line breaks, pool discharges,

[7] The number of observations is greater than the total number of outfalls visited due to some outfalls being visited multiple times.

or other illicit discharges/connections. Known and suspected groundwater sources were also identified, and rationales for each groundwater designation can be found in Attachment 3.

4.3.2.2 Highest Priority Persistently Flowing Outfalls

Several changes were made to the highest priority outfall locations compared to the previous monitoring period (2021-2022). The City of Carlsbad completed a study and subsequently reprioritized three major outfalls (see Table 20), namely 19C-1, 29B-94, and 55A-51, as it was determined that groundwater was the source of their flow. These three outfalls were replaced with three new sites (38D-13, 58A-73, and 63A-49) whose flow sources remain unidentified. For more details on the City of Carlsbad's source identification study, please refer to Attachment 6. In addition, the City of San Marcos replaced outfall OUT064 when it was determined that INL11196 was defined at the start of the receiving water.

Table 20. Carlsbad HPPF Outfall Site Lists

HPPF List 2021-2022 Monitoring Year	HPPF List 2022-2023 Monitoring Year	Notes
16C-61	16C-61	Same as 21/22
1D-21	1D-21	Same as 21/22
19C-1	38D-13	New HPPF site 22/23
29B-94	58A-73	New HPPF site 22/23
55A-51	63A-49	New HPPF site 22/23

4.3.2.3 Analytical Sampling

Non-Storm Water Action Levels (NALs)
The level of a pollutant or constituent during *dry weather* that when exceeded indicate control measures may need to be evaluated and source investigations may need to be prioritized.

In the 2022-2023 monitoring year, analytical sampling was conducted at 29 highest priority persistently flowing MS4 outfalls. The analytical results were compared to non-storm water action levels (NALs) to evaluate the potential contribution of pollutants from outfall discharges. NALs support the development and prioritization of water quality improvement strategies as they provide information to assess the effectiveness of strategy implementation and support the detection and elimination of non-storm water and illicit discharges to the MS4. Overall, in the 2022-2023 monitoring year, approximately 77% of analytical results from the highest priority outfall sites were below the applicable NALs. Summary result findings are as follows:

- All samples measured for dissolved oxygen met the NAL as did the majority of samples for pH (88%) and turbidity (91%).
- All results for methylene blue active substances (MBAS) were below the NAL.
- 100% of results for dissolved fractions of hexavalent chromium, trivalent chromium, iron, lead, silver , and zinc were below the applicable NAL.
- Dissolved cadmium, dissolved nickel, and dissolved copper are the only dissolved metals with results above the NAL.
- Total manganese had 35% of samples above the NAL, and 17% were above the NAL for iron.
- 85% of samples for total nitrogen and 72% of samples for total phosphorus were above the NALs.
- In all but two samples, at least one indicator bacteria result was above the applicable NAL.

4.4 3rd Party Monitoring Data

In November 2021, the Cities of Carlsbad and Oceanside received Buena Vista Creek monitoring data from the Preserve Calavera North San Diego County Watershed Monitoring Program, a 3rd party organization. The group's dataset from 2019 to 2023 can be found at the following link: https://www.preservecalavera.org/?page_id=2418

The data largely supports current PWQCs identified in the WQIP. The RAs will continue to review the 3rd party group's data as applicable.

4.5 Special Studies and Additional Investigations

Special studies[8] are conducted by the RAs to collect data and information that can assist in improving the effectiveness or efficiency of water quality strategies being implemented. Special studies can identify emerging conditions that prompt future attention, and may be completed on a regional, watershed, or jurisdictional basis. While special studies may be completed within a specific HA or focus area, the information obtained from special studies can often be applied to other WMA areas, sources, or programs.

The MS4 Permit defines minimum requirements for special studies related to HPWQCs, implemented in WMA, and require some form of participation by all the RAs within the WMA. The Carlsbad RAs completed and exceeded the number of MS4 Permit required special studies. The RAs also perform additional monitoring or assessments that do not necessarily fulfill MS4 Permit requirements of a special study. These studies are referred to as 'additional investigations' to differentiate between MS4 Permit defined special studies and are often performed on a jurisdictional level to address or research PWQCs.

Table 21 summarizes the special studies and additional investigations conducted in the WMA over the current MS4 Permit cycle and indicates whether the study is complete.

Table 21: Carlsbad WMA WQIP Special Studies and Additional Investigations Overview

MS4 Permit Special Study or Additional Investigation	Description	Status & Findings
San Diego Regional Reference Streams and Beaches Study (MS4 Permit Special Study) (City of Oceanside, City of Vista, City of San Marcos, City of Escondido, County of San Diego, City of Carlsbad, City of Encinitas, City of Solana Beach)	The study was designed to measure FIB concentrations and loads at streams and beaches minimally disturbed by anthropogenic activities (i.e., representative of "reference" conditions).	**Completed**. *Enterococcus* appears to be prevalent in environments minimally impacted by human activities. *Enterococcus* can often exceed the WQO during both dry and wet weather conditions in streams and dry weather in beaches. (Weston and AMEC Foster Wheeler, 2017)
Bight '13 Microbiology Drainage Water Study in Cottonwood Creek (MS4 Permit Special Study) (City of Encinitas)	This special study is designed to characterize inputs of human fecal contamination within the Cottonwood Creek drainage subarea, which may be contributing to FIB exceedances at Moonlight Beach.	**Completed**. The study concluded that human fecal pollution is ubiquitous in highly urbanized environments, is highly variable across sites, and the extent in drainage systems expands considerably during wet weather events.

[8] The MS4 Permit defines minimum requirements for special studies: related to HPWQCs, implemented in WMA, and require some form of participation by all the Copermittees within the WMA. The Carlsbad RAs completed and exceeded the number of MS4 Permit required special studies. The RAs also perform additional monitoring that are included as special studies. In some cases, these studies address PWQC and are performed on a jurisdictional level.

MS4 Permit Special Study or Additional Investigation	Description	Status & Findings
Clean Beaches Initiative Grant – Fecal Indicator Bacteria (FIB) Microbial Source Identification Study for Buccaneer Beach and Loma Alta Creek (MS4 Permit Special Study) (City of Oceanside)	This special study aimed to perform an initial watershed screening and microbial source identification project. The results were used to identify high-risk conditions to protect public health and implement management strategies to control fecal contamination in the Loma Alta Creek HA.	**Completed**. This research yielded valuable information as a first step toward comprehensively identifying host sources of fecal contamination and transport routes in the Loma Alta Creek watershed. The City continues to seek additional financial resources to initiate "Phase 2" source investigation work to follow this study. If funded, Phase 2 would entail source investigations at outfalls where human source markers (HF183) were detected during the initial study.
Upper San Marcos HA Flow and Water Quality Monitoring (MS4 Permit Special Study) (City of San Marcos, City of Escondido, County of San Diego)	Wet season continuous flow monitoring and wet weather event monitoring are conducted annually at SM-TWAS-1b. Data is used to calculate nutrient loads to track progress toward interim and final wet weather numeric goals related to nutrients. Dry weather flow monitoring is conducted at SM-TWAS-1a-DS and at the County of San Diego and City of San Marcos jurisdictional outfalls. Data is used to track progress toward interim and final dry weather numeric goals related to nutrients.	**Ongoing.** During the reporting period, the County of San Diego and the City of San Marcos and City of Escondido performed continuous flow monitoring in the Creek and collected wet weather samples for nutrients and total suspended solids. Monitoring efforts are reported in Attachment 2. and are presented in Section 3.3.2. .
Buena Vista Creek HA Dry Weather Special Study (Additional Investigation) (City of Carlsbad)	The City of Carlsbad conducted a dry weather special study at three persistently flowing outfalls in the Buena Vista Creek HA. The special study assessed the baseline flow observed, temporal flow patterns, fecal indicator bacteria concentrations, and temporal patterns of fecal indicator bacteria at the persistently flowing MS4 outfalls during dry weather conditions.	**Completed**. The study provided data to address data gaps related to non-storm water flows and applicable pollutant patterns and established baseline flows to measure subsequent flow reductions.
Agua Hedionda HA Dry Weather Special Study (Additional Investigation) (City of Vista, City of Carlsbad)	The City of Carlsbad conducted a dry weather special study at two persistently flowing outfalls in the Agua Hedionda HA. The special study assessed the baseline flow observed, temporal flow patterns, fecal indicator bacteria concentrations, and temporal patterns of fecal indicator bacteria at the persistently flowing MS4 outfalls during dry weather conditions.	**Completed**. The study provided data to address data gaps related to non-storm water flows and applicable pollutant patterns and established baseline flows to measure subsequent flow reductions.
	The City of Vista's dry weather special study was intended to characterize persistent dry weather flows from high priority major MS4 outfalls and establish baseline data from which future monitoring efforts can be compared. The special study and associated data were also intended to guide further investigations of pollutant sources.	**Completed**. The study included continuous flow monitoring to assess baseline and temporal flow conditions. Fecal indicator bacteria were also analyzed.

MS4 Permit Special Study or Additional Investigation	Description	Status & Findings
Agua Hedionda Lagoon Special Study (REC-1) – Phase I Monitoring (Additional Investigation) (City of Vista, City of Carlsbad, County of San Diego)	The Cities of Carlsbad and Vista and the County of San Diego developed a special study with periodic verification monitoring focused on Enterococcus. These efforts can demonstrate that conditions meet REC-1 WQOs and that the Lagoon remains unimpaired per the 303(d) Listing Policy. Consistent with Regional Board Resolution No. R9-2017-0030, supporting the use of Key Beneficial Uses and Key Areas concepts, the special study and verification monitoring will focus on the areas of most importance in the Lagoon and target the Inner Basin where the majority of the REC-1 usage occurs.	**Completed.** Conducted monitoring and assessment of Enterococcus in the lagoon. Actions completed are described in Section 4.1.3 and Appendix D. The complete investigation report was included as Attachment 11 of the FY22 Carlsbad WQIP Annual Report.
Agua Hedionda Lagoon Special Study (SHELL) – Phase I (Additional Investigation) (City of Vista, City of Carlsbad, County of San Diego)	The Cities of Carlsbad and Vista and the County of San Diego annually evaluate CDPH data to determine whether water quality conditions in the Outer Basin support commercial shellfish harvesting operations under open conditions. As part of this effort, the RAs may also develop a conceptual model to evaluate potential sources contributing to fecal coliform concentrations in the Outer Basin during the closed condition.	**Completed**. Assessed California Department of Public Health fecal coliform data. Actions completed are described in Section 4.1.3 and Appendix D.
San Marcos HA Dry Weather Special Study (Additional Investigation) (City of San Marcos, County of San Diego)	City of San Marcos - During September 2016, baseline flow data at the five highest priority persistently flowing major MS4 outfalls were collected along with sampling and analysis for indicator bacteria, nutrient concentrations, water height measurements, and flow volume characterization.	**Completed**. The study identified peak flow trends and identified and abated sources of over-irrigation, resulting in a reduction of dry weather flow compared to 2017 dry season baseline data. The city will continue its patrol program to conduct direct community outreach and implement enforcement where necessary.
	The County of San Diego's special study characterized the temporal flows and nutrient and fecal indicator bacteria (FIB) concentrations in dry weather runoff from selected persistently flowing outfalls in the Upper San Marcos HA.	**Completed**. The County of San Diego study was conducted during 2016 and 2017 at two major storm drain outfalls that discharge to Lake San Marcos, which drain residential areas within the unincorporated County of San Diego.
Escondido Continuous Flow Special Study (Additional Investigation) (City of Escondido)	The City of Escondido conducted a continuous flow monitoring special study in 2021 at five priority, persistently flowing outfalls in the Carlsbad WMA to characterize dry weather flow conditions and measure the effectiveness of strategies to reduce or eliminate controllable dry weather sources flows.	**Completed**. The data collected helped identify groundwater flow contributions and target field investigations for successful dry weather flow source observations and eliminations.
Escondido Creek HA Dry Weather Special Study (Additional Investigation) (City of Escondido, City of Solana Beach)	The City of Escondido installed continuous flow meters at three priority, persistently flowing MS4 outfalls in Escondido Creek HA for approximately two weeks per outfall in 2015. The study's purpose was to assess the volume of dry weather flows, baseline flows, and indications of irrigation runoff patterns or illicit discharges. Samples for indicator bacteria were also collected and analyzed.	**Completed**. Monitoring results suggested that continual dry weather sources (e.g., groundwater source) contributed to dry weather flow at all three sites, and episodic dry weather flow (e.g., irrigation runoff) contributed to dry weather flow at two sites.

MS4 Permit Special Study or Additional Investigation	Description	Status & Findings
	The City of Solana Beach's special study is intended to characterize persistent dry weather flows from high priority major MS4 outfalls and establish baseline data from which future monitoring efforts can be compared. The special study and associated data may also be used to guide further investigations of pollutant sources.	**Completed**. The study provided data to address data gaps related to non-storm water flows and applicable pollutant patterns and established baseline flows to measure subsequent flow reductions.
Dry Weather MS4 Outfall Flow Source Investigation (Isotope/Geochemistry Analysis) (Additional Investigation) (County of San Diego)	The County of San Diego's special study aims to quantify the percentage of imported water in the monitored non-storm water outfall discharges.	**Completed**. The findings showed dry weather flow sources ranging from nearly all imported water to all local groundwater with flows at most sites comprising a mixture of sources. In 2020, the County of San Diego continued flow data collection at most outfall locations monitored in 2018 and 2019. However, due to the COVID-19 social distancing-related restrictions isotope, geochemistry, and indicator analysis were not conducted.
Highest Priority Persistent Flow Outfall Source Identification (City of Carlsbad)	The study was performed to refine flow source characterization and identify likely sources of flow.	**Completed.** For five highest priority persistent flow outfalls, the study identified likely sources, including groundwater, irrigation runoff and other transient discharges. The report is included as Attachment 6.
Ground Water Study – Dry Weather Flow Source Investigation (City of Encinitas)	The study was performed to identify and characterize the flow sources at five highest priority persistent flow outfalls.	**Completed**. The study showed that non-storm water flow sources in the city MS4 ranged from nearly all tap water to nearly all groundwater with flows at other sites comprised of a mixture of tap and groundwater. The report is included as Attachment 8.
McClellan-Palomar Airport Water Quality Treatment Facility and Long-Term Effectiveness Monitoring (Additional Investigation) (County of San Diego)	The study was performed to determine the effectiveness of a water quality treatment facility (installed in 2006) at pollutant removal during low-flow storm events and comply with Proposition 13 Grant requirements.	**Ongoing.** Additional wet weather BMP effectiveness verification monitoring was performed in FY23. Monitoring at the treatment facility demonstrated effective flow attenuation and pollutant load removal for metals, nutrients, and sediment. The FY23 monitoring report is included as Attachment 9.

4.6 Re-Evaluation of Water Quality Conditions

Although receiving water quality conditions do not change substantially from year to year, the RAs may evaluate whether water quality data and findings demonstrate a compelling need to re-evaluate current HPWQCs and PWQCs. In doing so, the RAs may consider:

- Whether water quality improvement outcomes were achieved in MS4 discharges or receiving waters,
- Data, information, and recommendations provided by the public,
- Water quality monitoring collected after initial WQIP development,
- Results from special studies,
- New and developing regulations related to water quality conditions,
- Revised 303(d) listings,
- Basin Plan amendments related to water quality conditions and/or
- RWQCB recommendations.

The RAs re-evaluated water quality conditions in 2019-2020, and as a result, the WQIP was updated. Water quality conditions were not re-evaluated during the FY23 reporting period.

5 Adaptive Management and Revisions

As part of the adaptive management process, the RAs use information and data acquired from WQIP implementation and water quality monitoring to inform management decisions related to water quality conditions, numeric goals, strategies, and associated schedules. As necessary, RAs may revise the WQIP, respective JRMPs, and/or BMP Design Manuals based upon new data, information, and/or feedback received during the implementation of the WQIP.

Updates and minor modifications to the WQIP, JRMPs, and BMP Design Manuals are presented in this section.

5.1 Updates

The adaptive management process may prompt updates to the WQIP and respective JRMPs. Updates to the WQIP require the collaboration of the RAs and follow, as applicable, a public participation process similar to that implemented during WQIP development. The public participation process includes soliciting data and information and consultation with the WQIP Consultation Panel. Updates can be provided in the WQIP annual reports or the Report of Waste Discharge (ROWD). WQIP updates may include significant changes to the highest priority water quality conditions, numeric goals, or monitoring and assessment. BMP Design Manual updates or JRMP updates, such as program modifications and/or amendments to the JRMPs, are performed as needed by RAs.

Updates to the WQIP, respective JRMPs, and BMP Design Manuals during the reporting period are presented in the following sections.

5.1.1 JRMPs and BMP Design Manuals

FY23 JRMP and BMP Design Manual updates are presented below.

BMP Design Manual Update

- The City of Carlsbad updated its BMP Design Manual in January 2023 to clarify trash capture implementation, incorporation of Green Street Guidance, and general errata.
- The City of Encinitas updated its BMP Design Manual during this period to incorporate updated definitions to routine pavement maintenance projects and to adopt sizing guidance and methodology for proprietary biofiltration systems to meet the MEP treatment standard for PDPs. The draft final version of the BMP Design Manual has been completed and will be included in the City's JRMP Annual Report submittal to the Regional Board. These updates will be implemented pending receipt of a formal acceptance letter from the Regional Board.
- The City of Escondido updated its Storm Water Design Manual (BMP Design Manual) in October 2022.
- The City of Oceanside updated its BMP Design Manual to include Trash Amendments requirements for new and re-development meeting PDP thresholds.
- The City of San Marcos updated its BMP Design Manual in February 2023. A summary of the updates is provided in the City's JRMP Annual Report, which is provided in Appendix C. The updated BMP Design manual is available at: Development Planning | San Marcos, CA (san-marcos.net)

JRMP Updates

- The City of Carlsbad:
  - updated Appendix A – MS4 Map, and
  - Appendix B – Existing development Map
  - The City of Carlsbad's updated JRMP is available on the city's website: https://www.carlsbadca.gov/departments/community-development/land-development-engineering

- The City of Encinitas:
  - updated JRMP inventories
  - included language to incorporate updated centralized inspection and reporting database, and
  - updated Post-construction BMP inspection prioritization processes.
  - The City of Encinitas' updated JRMP is available on the city's website: https://www.encinitasca.gov/government/departments/public-works/stormwater-management
- The City of Escondido:
  - Updated inventory for permitted channel maintenance sites (RGP 94)
  - The City of Escondido's updated JRMP is available on the city's website: https://escondido.org/environmental-programs
- The City of Vista:
  - updated municipal facility inventory
  - updated existing development program to include property-based Industrial/Commercial inspections
  - The City of Vista's updated JRMP is available on the city's website: https://www.cityofvista.com/departments/engineering/water-quality-protection/watersheds

5.2 Minor Modifications

Corrections, additions, or administrative changes to the WQIP or respective JRMPs may be needed for document accuracy or to update implementation efforts. Minor modifications may include changes to activity frequencies, facility inspection inventories, or focus areas identified in the WQIP. These modifications may arise based on the implementation feedback process and may require quick management decisions to support the identified goals and schedules.

Minor modifications identified for the WQIPs during the FY23 reporting period are presented below.

6 Conclusions and Recommendations

RAs successfully implemented the WQIP during the reporting period through collaborative and proactive efforts on the regional, watershed, and jurisdictional levels. Successful programmatic and water quality outcomes achieved in FY23 helped to protect, preserve, enhance, and restore water quality and designated beneficial uses of waterways within the WMA. Through these efforts many interim goals were achieved and significant progress towards final numeric goals were achieved.

The RAs will continue to implement strategies and make program adjustments to maintain progress in achieving interim and final goals. In FY24, several RAs will be continuing adaptive management processes to evaluate HPWQCs and numeric goals in several HAs. These RAs will coordinate with RWQCB staff and provide rationale and updated numeric goals to the RWQCB for approval before implementation.

Dry and wet weather MS4 outfall monitoring for the 2022-2023 monitoring year provided data and information regarding MS4 water quality conditions (see Attachment 3). During the reporting period, 810 dry weather MS4 visual observations were performed, and a total of 33% of the 483 major MS4 outfalls were classified as dry (i.e., dry for three consecutive site visits).

During dry weather sampling, all results for the dissolved fractions of hexavalent chromium, trivalent chromium, iron, lead, silver, and zinc were below the NAL in 100% of the analytical samples. During wet weather outfall sampling, 75% of the results met applicable action levels. Parameters below SALs include total cadmium, total copper, total lead, total zinc, and turbidity.

During FY23, RAs collaborated to implement the WQIP and address comments from the RWQCB. A revised WQIP was submitted in September 2021 and accepted by the RWQCB in December 2021. The RAs are committed to continuing JRMP and WQIP implementation in FY24 and working collaboratively to improve water quality throughout the Carlsbad WMA.

As the MS4 Permit reissuance continues, it is recommended that the CWMA RAs continue their history of engagement with RWQCB staff and in the region to work towards streamlined reporting efforts and meaningful program planning, implementation, and reporting.

7 References

AECOM, Nordby Biological Consulting, and Moffat & Nichol. 2022. 2021 Wetland Habitat and Hydrology Annual Monitoring Report for the San Elijo Lagoon Restoration Project – Prepared for the Nature Collective.

California Department of Public Health 2023. Triennial Sanitary Survey Update Report: 2019-2022, Shellfish Growing Area Classification for Agua Hedionda Lagoon, California. Technical Report No. 23-13.

Carlsbad WMA Responsible Agencies. 2021. *September 2021 (Update) Carlsbad Watershed Management Area Water Quality Improvement Plan.* Prepared by MOE et. al.

Environmental Science Associates (ESA). 2020. Loma Alta Slough Wetlands Enhancement Final Water Quality Technical Report.

Fetscher, A.E., M. Sutula, L. Busse, and E. Stein. 2013. Condition of California Perennial Wadeable Streams Based on Algal Indicators. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Technical Report SWAMP-MR-RB9-2013-0007. October 2013.

Heal the Bay. 2023. 2022-23 Annual Beach Report Card. Available at: https://healthebay.org/wp-content/uploads/2023/06/Beach-Report-Card-2022-2023.pdf/

Mazor, R.D. 2015. Bioassessment of Perennial Streams in Southern California: A Report on the First Five Years of the Storm Water Monitoring Coalition's Regional Stream Survey. Southern California Coastal Water Research Project Technical Report 844.

Nature Collective. 2021. The Beginning of Finishing Touches + Lagoon Restoration. Available at: https://thenaturecollective.org/2020/03/02/the-beginning-of-finishing-touches-lagoon-restoration/. Accessed on September 13, 2021.

SCCWRP. 2015. Bioassessment Survey of the Storm Water Monitoring Coalition Workplan for Years 2015 through 2019 Version 1.0. Prepared by Southern California Coastal Water Research Project Storm Water Monitoring Coalition, Costa Mesa, CA. September 2015. Technical Report 849.

SCCWRP. 2021. S*MC Bioassessment Survey of the Storm Water Monitoring Coalition, Workplan for Years 2021 through 2025, Version 1.0* (SMC Workplan). Prepared by Raphael D. Mazor. February 2021. Technical Report #1174. Available at: https://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/1174_SMCBioassessmentWorkplan.pdf

State Water Board (State Water Resources Control Board). 2018. Part 3 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California – Bacteria Provisions and a Water Quality Standards Variance Policy. August 7, 2018.

Weston Solutions and AMEC Foster Wheeler. 2017. San Diego Region Report of Waste Discharge and Regional Monitoring and Assessment Report. Prepared for the San Diego Region Copermittees.

Weston Solutions. 2019. Carlsbad WMA Participating Agencies Sediment Quality Objectives Confirmation Monitoring Work Plan.

Weston Solutions. 2021. Sediment Stressor Identification Monitoring Work Plan. Prepared for: Carlsbad Watershed Management Area Participating Agencies. March 2021.